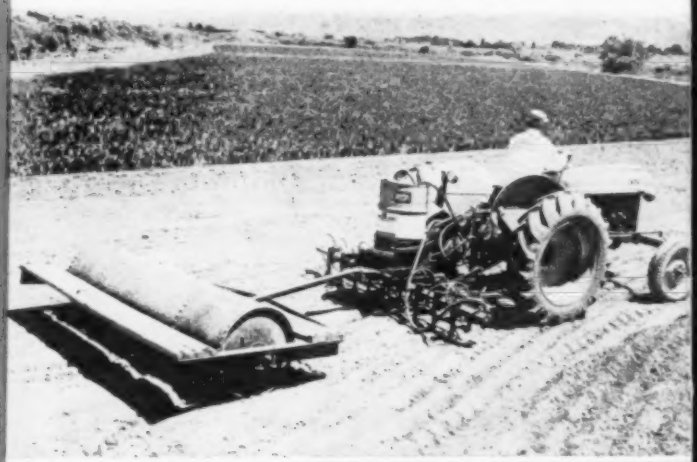
AGRICULTURAL *Chemicals*

IN THIS ISSUE:

- Granular Pesticides
- Granular Fertilizers
- Organophosphate Ovicides
- Caking in Fertilizer
- Endothal Weed Killer
- Fertilizer Drying
- Biological Pesticides
- Urea in Fertilizer Solutions

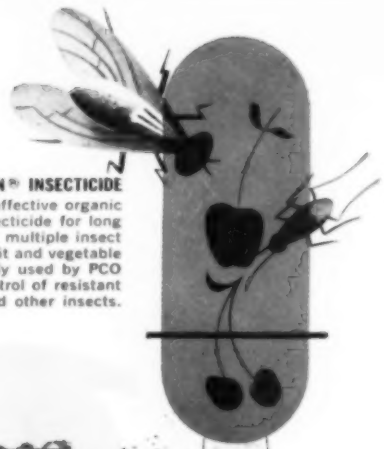


APRIL, 1959

Get more sales—more satisfaction

WHEN YOU SELL OR USE

geigy agricultural chemicals



DIAZINON® INSECTICIDE
Versatile effective organic phosphate insecticide for long residual fly control, multiple insect control on many fruit and vegetable crops. Extensively used by PCO industry for control of resistant roaches and other insects.

Geigy
METHOXYCHLOR INSECTICIDE
Multi-purpose insecticide. Long residual action against many insect species attacking fruit, vegetable, forage crops, and stored grain. Controls horn flies, cattle lice and ticks on livestock.

New formulations

SIMAZINE 4G (4% granules)

SEQUESTRENE NaFe Iron Chelate on Vermiculite

DIAZINON 2½G (2½% granules)

SEQUESTRENE® METAL CHELATES
Original metal chelates in agriculture. For correction of minor element deficiencies of ornamentals, fruit trees, vegetables, turf. Compatible with most commonly used insecticides, fungicides, fertilizers.

ATRAZINE™ HERBICIDE
New herbicide for non-selective industrial weed control on non-cropped land. May be applied post-emergence as well as pre-emergence. Controls annual broadleaf weeds and grasses and many perennial weeds. Extremely low toxicity to humans and animals.

SIMAZINE™ HERBICIDE
Pre-emergence herbicide for use on corn. One application gives season-long effective weed control. Also for weed control in nursery stock, and at higher levels of application, as an industrial herbicide. Extremely low toxicity to humans and animals.

CHLOROBENZILATE® MITICIDE
Safe, effective miticide for use on deciduous and citrus fruit, ornamentals and nursery stock. Long residual action.

ORIGINATORS OF Geigy DDT INSECTICIDES

GEIGY AGRICULTURAL CHEMICALS • *Division of Geigy Chemical Corporation* • Saw Mill River Road, Ardsley, N.Y.

SWEET MUSIC TO BAG BUYERS

Chase customers call the tune—and Chase follows through. The key to our whole business is giving *you* the bags you want, when *you* want them, made right, and priced right. But it doesn't end with filling your order . . . Chase continues working in complete harmony with you . . . making available the newest and most efficient materials, helping cut costs, eliminating waste, by individualized attention to your requirements. Some may call it "extra" service . . . at Chase, we know it's the *ONLY* right way to serve you.

Our 112th Year

CHASE

BAG COMPANY

General Sales Offices: 155 East 44th St., New York 17, N.Y.

BAG PLANTS AND SALES OFFICES COAST TO COAST
—A NATIONWIDE STAFF OF BAG SPECIALISTS

This Month's Cover

With the 1959 season underway, growers are preparing soils for planting. Upper photo (*Courtesy Stauffer Chemical Co.*): application of Vapam through special blade ejector. Roller compacts earth, helps liberated gas do its work of killing fungi, weeds and soil insects before escaping.

Bottom photo (*Courtesy International Harvester Co.*) Application of liquid fertilizer for six-row trailing-type corn and cotton planter.

Publisher
Wayne E. Dorland

Editor
Eleonore Kanar

Associate Editor
Richard D. McNally

Advertising Manager
Ralph Dorland

District Managers
Roger Appleby
William Ryan

Circulation Manager
David Tryon

MEMBER AUDIT BUREAU OF CIRCULATIONS

Vol. 14, No. 4 April, 1959

AGRICULTURAL *Chemicals*

ARTICLES

FEATURES

PUBLISHED monthly on the 1st, by Industry Publications, Inc.

ADVERTISING and Editorial Office, P. O. Box 31, Caldwell, New Jersey.

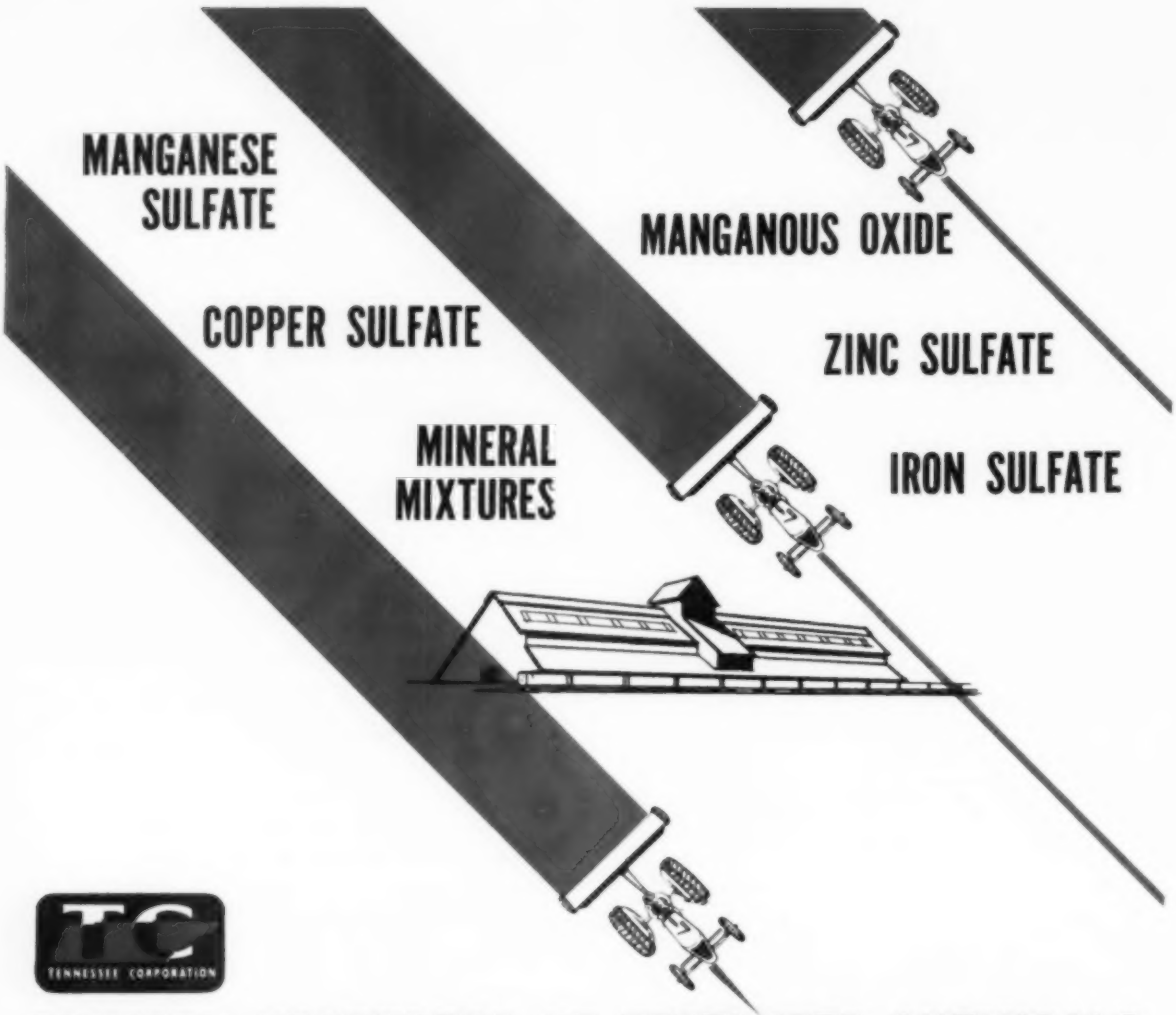
PUBLICATION Office: 123 Market Pl., Baltimore, Md.

ENTERED as second-class matter November 4, 1949 at the Post Office at Baltimore, Md., under the Act of March 3, 1879.

SUBSCRIPTION RATES: United States, 1 year, $3.00; 2 years, $5.00. Canada and Pan American countries, 1 year, $4.00; 2 years, $7.00. All other foreign countries, 1 year, $9.00; 2 years, $15.

SINGLE COPIES: current issue: $0.50; all back numbers $1.00. Postage and handling charges for foreign countries on single copies: $1.00. Claims for missing numbers will not be allowed if received more than 60 days from date of mailing. No claims allowed from subscribers arising from failure to notify the Circulation department of a change of address, or because a copy is "missing from files."

ADVERTISING RATES known on request. Closing date for copy—5th of month preceding month of issue.



TC TENNESSEE CORPORATION

PRIMARY PRODUCERS OF FERTILIZER CHEMICALS

We have manufactured nutritional trace elements for application in fertilizers and maintained a consistent research program in this field for more than 30 years. Our background and basic position in this field is your assurance of a plentiful supply of quality materials.

NUTRITIONAL TRACE ELEMENTS ARE OUR BUSINESS

Foliar Nutritional Products Include NU-IRON, NU-Z, ES-MIN-EL

YOU cut cost with combined carloads from one basic source.

YOU can save money, time, plant space and effort through the use of our custom formulated mineral mixture service.

WE back up our products with service, research and technical assistance.

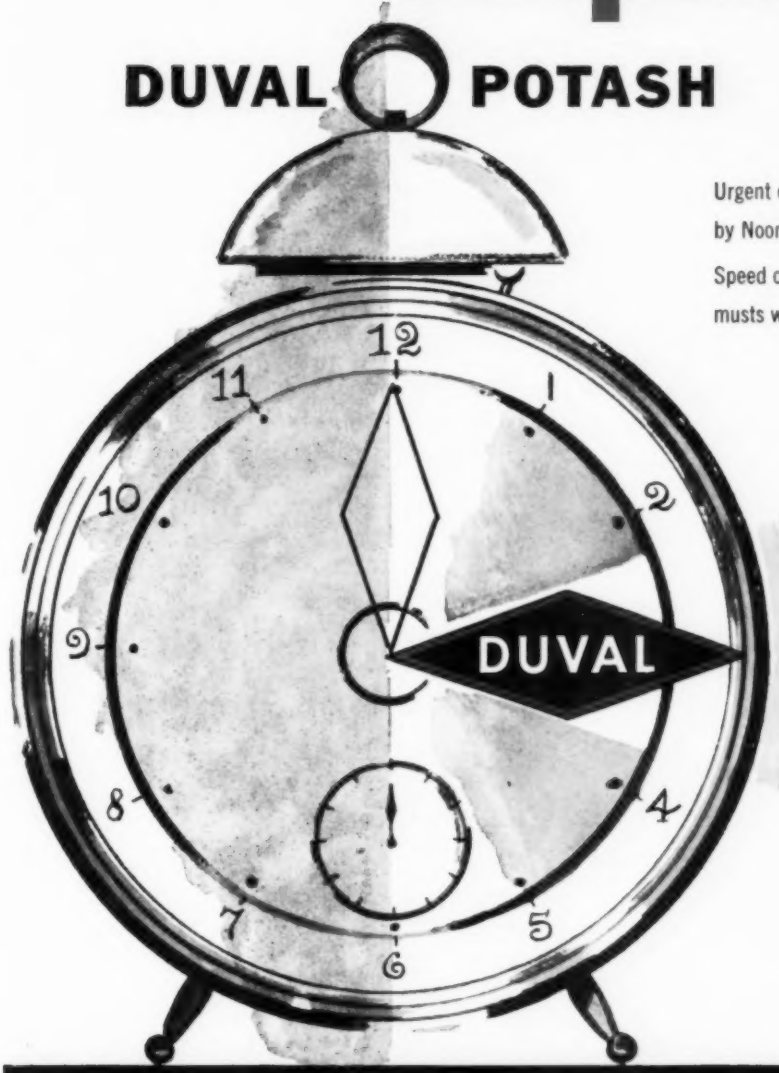
Make request on your Company letterhead for samples or literature.

TENNESSEE TC CORPORATION

617-29 Grant Building, Atlanta, Georgia

same day shipment

DUVAL POTASH



Urgent orders shipped same day if received by Noon or possibly mid-afternoon.

Speed of handling and quality are always musts with Duval and Ashcraft-Wilkinson Co.

High Grade Muriate of Potash...

DUVAL SULPHUR & POTASH COMPANY

Exclusive Distributors

ASHCRAFT-WILKINSON CO.

HOME OFFICE

ATLANTA, GEORGIA

Cable address: Ashcraft

Norfolk, Va. • Charleston, S. C. • Tampa, Fla. • Jackson, Miss. • Columbus, Ohio • Montgomery, Ala. • Des Moines, Iowa

in FOR extra profits

BEANS SWEET CORN PEAS POTATOES

SELECTIVE

Sinox PE

WEED KILLER

Dealers and distributors who are looking for a safe, profitable, selective herbicide will find it in SINOX PE.

For years this nationally-advertised money-maker has been first choice among growers as a compound to prevent the growth of weeds . . . tops among dealers for the profits it brings. See for yourself.

NO OBLIGATION FOR TEST SAMPLES AND TECHNICAL DATA YOU REQUIRE.

5 Gallon Can . . . also available in 30 gallon drums.

STANDARD Agricultural **CHEMICALS** INC.

1301 JEFFERSON ST., HOBOKEN, N. J.

PANASOL

Aromatic Solvents

a cut above other solvents for pesticide formulating

Pick the product you want to formulate, and you'll find a PANASOL Solvent you will want to use in your formulation. PANASOL Solvents offer high aromaticity and solvency to help you make quality products *competitively* priced. The low phytotoxicity of PANASOL RX-4 and AN-2K permits you to use them with assurance in crop sprays. Mild odor and light, clear color of PANASOL AN-2 makes it suitable for household spray formulations. PANASOL AN-1 and AN-3 are useful in such specialty formulations as Insecticide-Fertilizer combinations. The ease with which PANASOL Solvents formulate with active ingredients simplifies manufacturing.

The whole PANASOL Solvent story is in the hands of your Amoco Chemicals salesman. He's ready to bring it to you when you call. Or write for Bulletin A2. Your inquiry will receive immediate attention.

Typical Properties

PANASOL Solvent No.	AN-1	AN-2	AN-2K	AN-3	AN-3K	RX-3	RX-4
Distillation 2F., ASTM	D-158	D-158	D-158	D-158	D-158	D-86	D-850
IBP, °F.	400	420	398	450	440	276	282
EP, °F.	494	520	525	534	705	—	—
DP, °F.	—	—	—	—	—	360	320
Specific Gravity, 60/60°F.	0.974	0.986	0.950	0.997	0.943	0.843	0.865
Aromatics, Vol. %	98	99	82	99	71	76	94
Mixed Aniline Point, °F.	55	54	75	54	100	84	59
Flash Point, COC., °F.	190	210	200	225	220	—	—
Flash Point, TCC., °F.	—	—	—	—	—	82	85
Solubility*							
DDT (tech.)	39	42	39	43	28	25	29
BHC (tech.)	29	34	41	31	43	23	28
Lindane	9	10	11	14	5	10	15
Dieldrin	26	28	26	27	25	26	29

*Wt. parts in 100 parts solution at 32° F.

AMOCO CHEMICALS

AMOCO CHEMICALS CORPORATION

910 South Michigan Ave., Chicago 80, Illinois

Special to the "Ag Chemical" Trade:

TWO GREAT NAMES BRING YOU GREAT NEW PROFIT POSSIBILITIES!

MILLER CHEMICAL licensed by UNION CARBIDE

Miller Chemical and Fertilizer Corp. . . . a name you can depend on for greater sales and profits in the agricultural chemicals field . . . now offers even greater opportunity to profit-minded distributors.

Miller is the exclusive licensee for "658" Fungicide — one of the most important agricultural products developed by Union Carbide . . . a recognized leader in the chemical field.

As producers and manufacturers (under license) of this Union Carbide profit leader, Miller is making "658" Fungicide available to distributors across the country. Miller also produces Tomato-Set Hormone Spray, Nutri-Leaf Soluble Fertilizer and 40% TEPP.

YOU CAN DEPEND ON MILLER Products

MILLER "658" Fungicide *AGAIN AVAILABLE!*

(Formerly CRAG Fungicide "658")

Thoroughly tested copper-zinc-chromate complex that has provided excellent results for growers and in agricultural experimental stations.

Controls diseases on Potatoes, Tomatoes, Cucurbits, Peanuts, Citrus, Avocados, Azaleas and Turf.

- **One of the highest yielding fungicides on tomatoes (1958 tests)**
- **Highly effective against tomato late blight, early blight, grey leaf spot and bacterial leaf spot.**
- **Supplies needed trace elements — improves vegetable quality**
- **Safe to use — no residue tolerance restrictions on harvested crops**
- **Sticks better — as spray or dust**
- **Economical — does not break down in storage or on plants**

WRITE TODAY FOR COMPLETE INFORMATION— OR ASK YOUR MILLER REPRESENTATIVE

MILLER CHEMICAL and FERTILIZER CORP.
BALTIMORE 15, MARYLAND

Welcome card

TEL. NO. HARRISON 7-

STANDARD

G. W. DAY

STANDARD OIL COMPANY
910 SOUTH MICHIGAN AVENUE
CHICAGO 5, ILLINOIS

NITROGEN PRODUCTS
REPRESENTATIVE

to buyers of

Anhydrous Ammonia and Nitrogen Solutions

A welcome card? Yes, indeed. Here's why:

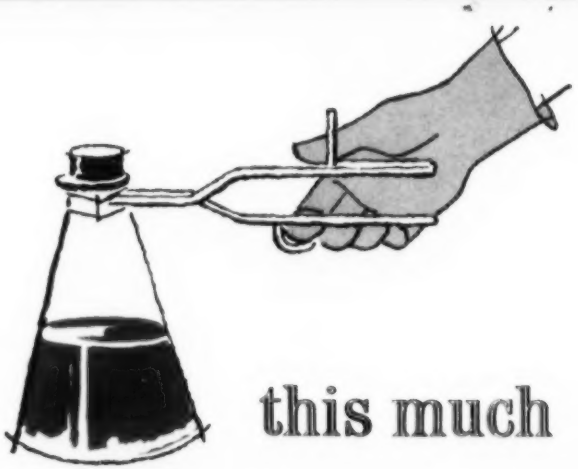
1. This card is presented by a man from a company that backs up its salesmen's promises for delivery and for products that meet a customer's specifications.

2. The customer doing business with Standard Oil knows he is buying from a company with an established reputation . . . a company he knows will give him fair treatment, service and product quality.

3. Standard's modern Ammonia and Nitrogen Solutions plant is located in the heart of the country's largest rail- and truck-shipping area. To a customer this means fast, sure deliveries . . . deliveries that can be easily controlled because routes are direct and distances short.

A modern plant capable of producing Ammonia and Nitrogen Solutions on specification. A supplier who knows a customer's requirements *and delivers*. These add up to service a Midwest buyer of Ammonia and Nitrogen Solutions can depend upon. Would you like a Standard Oil man to call on you? Write, wire or telephone Nitrogen Products Department, **Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 5, Illinois.**

You expect more from STANDARD and get it!



this much Methyl Parathion...

A little Victor methyl parathion puts the *cide* into those pesticides that knock boll weevils and other cotton pickin' pests for a loop.

Cotton farmers and pesticide formulators both bank on the fatal charm of Victor methyl parathion – whether used as a dust, a wettable powder, or an emulsifiable concentrate.

Perhaps you'd like to unload some of your problems . . . make your product more marketable, more economical to produce. You're in the driver's seat, of course, but selecting Victor phosphates, formates, and oxalates can pay dividends—as they have for many others in more than 40 industries. Write on your letterhead for literature of the chemical you are interested in. We'll have data on your desk before you can say, "It *pays* to see Victor."

Victor Chemical Works, Box 572, Chicago 90.

VICTOR
Dependable Name in
Chemicals
for 61 Years

this much 10-52-17

Dissolve one ounce of Victor Take-Hold® in a gallon of water and you have the perfect transplanting solution for seedlings and setouts.

High-analysis (10-52-17), Take-Hold plant food speeds formation of early root structure . . . helps seedlings overcome "setback shock" at transplanting time . . . resulting in earlier development. Nurserymen and commercial growers like to be in this preferred position of commanding "early bird" prices.

Producers of commercial fertilizers are in a preferred position, too, when they specify Victor P.F.S. (phosphatic fertilizer solution), for Victor—a leading producer of P.F.S.—offers fast and frequent tank car and tank truck delivery from five production points, strategically located from coast to coast.

For a fast start to a solution of *your* problem—either plant food or phosphatic fertilizer solution—contact Victor's technical service department. Or write on your company letterhead for a copy of our new bulletin "Handling and Storage of Phosphoric Acid." It's an easy way to learn why *it pays to see Victor.* Victor Chemical Works, Box 572, Chicago 90.

Texaco can save you the freight on 1 car out of 3

NEW 50% SOLUTION GIVES YOU MORE NH_3 PER SHIPMENT

Because Texaco has the handling know-how and equipment, it is now practical to ship aqua ammonia at 50% concentration in either tank cars or tank trucks. You get 57% *more* ammonia than in the same volume of regular 29.4% solution.

At your plant, 50% solution is unloaded and diluted to 29.4% without additional investment in handling equipment.

Thus, two tank cars of Texaco 50% NH_3 solution actually give you more ammonia than three cars of the standard 29.4% solution—saving you shipping costs on one car.

Only Texaco offers you this advantage. In addition, Texaco's technical advisory personnel will be glad to discuss with you any questions concerning this unique saving, development of a new product or improvement of an old one. Possibly Texaco research has already solved a problem similar to yours, saving you the expense of duplicate experimentation.

The box at the left shows you some of the high-quality petrochemicals available from Texaco. Whether you need a product or a process, call or write:

The Texas Company, *Petrochemical Sales Division*, 332 South Michigan Avenue, Chicago 4, Illinois, or 135 East 42nd Street, New York 17, N. Y.

TEXACO PETROCHEMICALS: Aqua ammonia, anhydrous ammonia, nitrogen solutions, diisobutylene, odorless mineral spirits, naphthenic acid, propylene tetramer and rust inhibitors.

TEXACO
REG. T.M.

TEXACO
PETROCHEMICALS

MEETING CALENDAR

April 5-10 — 135th national meeting, American Chemical Society, Boston, Mass.

April 8-11 — Symposium on forest soils, Louisiana State University, Baton Rouge, La.

May 18-20 — 45th mid-year meeting, Chemical Specialties Manufacturers Assn., Hotel Drake, Chicago, Ill.

May 20-21—Chemical Market Research Assn., annual meeting, Plaza Hotel, New York.

June 9-10 — Seventeenth Annual Convention of the Association of Southern Feed and Fertilizer Control Officials, Velda Rose Motel, Hot Springs, Arkansas.

June 14-17 — National Plant Food Institute, Annual Convention, Greenbrier Hotel, White Sulphur Springs, W. Va.

June 22-25—Agricultural Institute of Canada, Annual Meeting with cooperating societies, Winnipeg, Man.

June 29-30 — California Fertilizer Conference, University of California, Davis.

July 7-9 — Pacific Northwest Plant Food Assn., 10th annual Regional Fertilizer Conference, at Tacoma, Wash.

July 29—Kentucky Fertilizer Conference, Guignil Theater, University of Kentucky campus, Lexington.

Aug. 3-7 — Gordon Research Conf. on Biochemistry and Agriculture, Kimball Union Academy, Meridan, N. H.

Oct. — Third week of—Symposium on the Insect Resistance Problem. Sponsored by NACA and ESA, Washington, D. C.

Oct. 21-23—National Agricultural Chemicals Association, 26th Annual Meeting, French Lick-Sheraton Hotel, French Lick, Indiana.

Nov. 4-6—Fertilizer Industry Round Table, Mayflower Hotel, Washington, D. C.

Nov. 9-11 — California Fertilizer Assn., 36th Annual Convention, Fairmont Hotel, San Francisco.

Nov. 16-20 — National Aviation Trades Assn., 20th Annual Convention, New Orleans, La.

Nov. 30-Dec. 3—Ninth annual meeting, Entomological Society of Canada and 96th annual meeting of Entomological Society of Ontario will be held jointly with the annual meeting of the Entomological Society of America, Detroit, Mich.

Dec. 7-9 — 46th annual meeting, Chemical Specialties Manufacturers Assn., Mayflower Hotel, Washington, D. C.

WHY LET YOUR MONEY SLIP AWAY?

Hudson's Super-Magnetized
Multiwalls
Cut Slippage
Prevent Breakage

FIELD REPORT

TO: B.D.

RE: How Super-Magnetized Cut Claims for [redacted].

Because his is an expensive product, Mr. [redacted] insists on maximum protection for his shipments. Losses through sack breakage due to slipping had become something of a phobia with him. Since he switched to our Super-Magnetized Multiwalls he has not had a single claim arising from slippage.

Actual cash savings have far and away absorbed our upcharge for these bags. He also reports an improvement in customer good will.

Hudson Bags increase your sales — cut your costs!

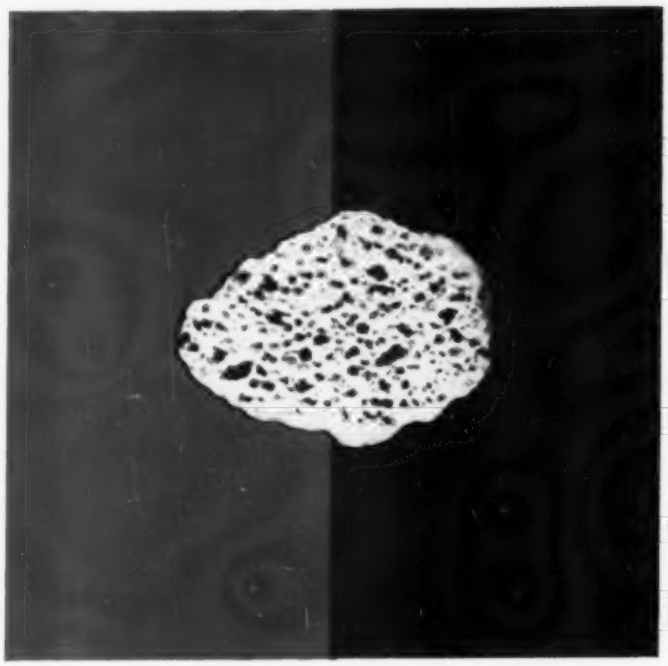
HUDSON MULTIWALLS

for further information write:

HUDSON PULP & PAPER CORP.
477 Madison Avenue • New York 22, N. Y.

Plants at Pine Bluff, Ark. • Palatka, Fla. • Wellsburg, W. Va.

Swift's PC-47



This particle of Swift's PC-47 Triple Superphosphate is magnified 9 times actual size.

The 47% A.P.A. Triple Superphosphate with over

14 BILLION AMMONIA TRAPS PER TON

That's positive ammoniating-ability — the kind that builds satisfaction and repeat sales.

Swift's new PC-47 Triple Superphosphate is the result of the extra care Swift devotes to making its phosphate operations serve you better . . . the same extra care in processing to assure complete uniformity of grade and grind . . . the same extra care that satisfies your delivery requirements.

Before you settle on your source of triple superphosphate, phosphate rock or ground phosphate, ask to have a Swift Phosphate Center representative outline what extra care can mean to you. Or write for illustrated brochure to SWIFT & COMPANY, Phosphate Center, Bartow, Florida.

THE SERVICE SOURCE FOR ALL YOUR PHOSPHATE NEEDS

P-2

Swift
104TH YEAR

To Serve Your Industry Better

WITH PHOSPHATE ROCK,
GROUND PHOSPHATE ROCK
AND PC-47 TRIPLE SUPERPHOSPHATE

THE QUALITY TRIO

DILUEX
A SUPERIOR NON-ABRASIVE DILUENT FOR
INSECTICIDES
FUNGICIDES
SPRAYS
DUSTS

FLOREX
GRANULAR ADSORBENT CARRIER
FOR
INSECTICIDES
FUNGICIDES
HERBICIDES

DILUEX A

for effective pesticide formulation

Floridin fuller's earth is widely recognized as the superior natural adsorbent that combines economy with outstanding sorptive efficiency. It is most widely used by formulators in three grades:

- Diluex "A," the finely ground, highly adsorptive degritted fuller's earth.
- Diluex, produced from the same high quality mineral, but not as finely ground.
- Florex, in standard meshes for granular processing requirements.

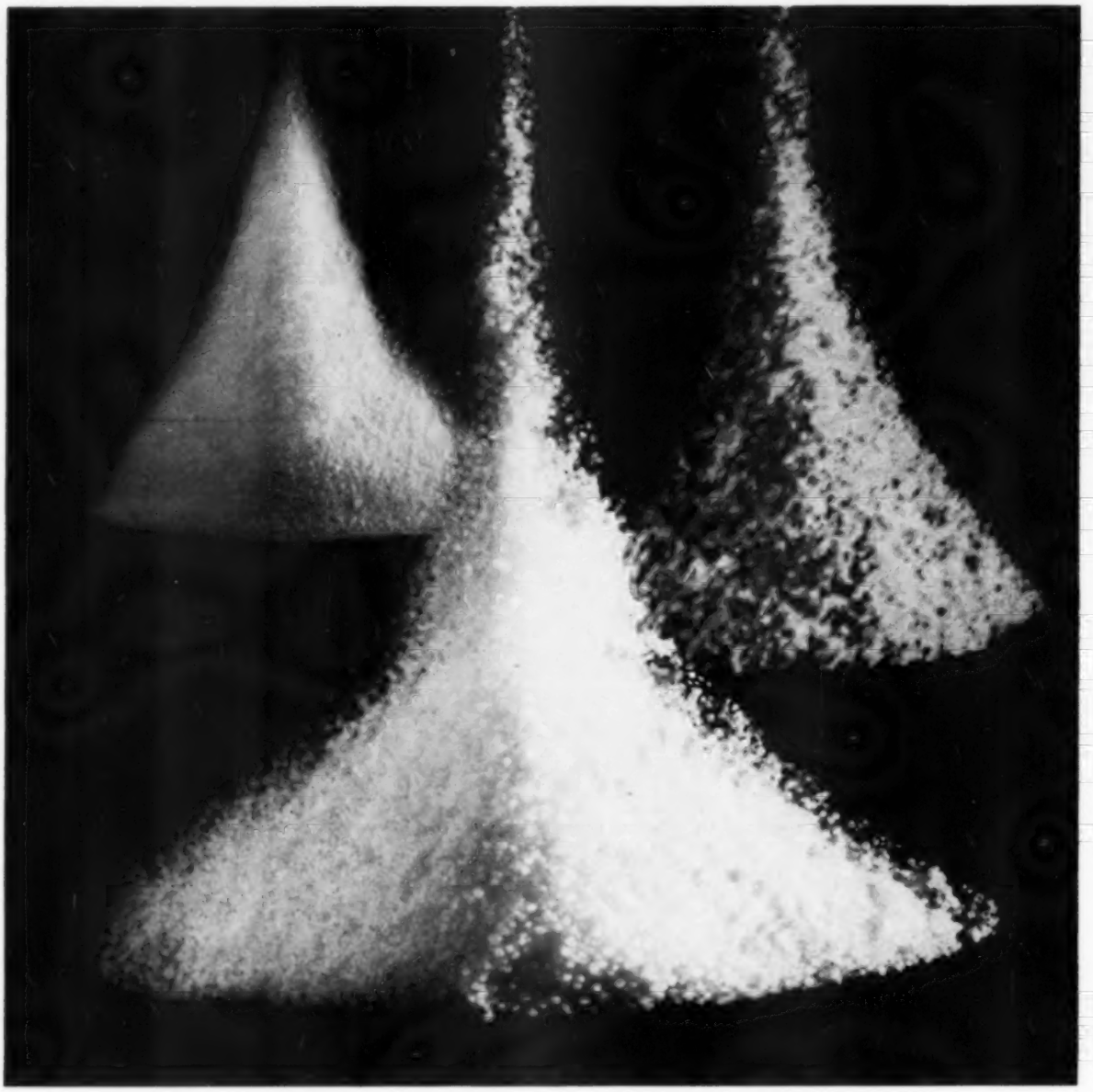
In addition to inherent advantages of the basic products, rigid quality control is maintained constantly.

Do you have our latest general agricultural chemical bulletin that contains specifications and extensive processing information? It's free. Write today. Just tear out this ad and attach it to your business letterhead and sign; we'll do the rest.

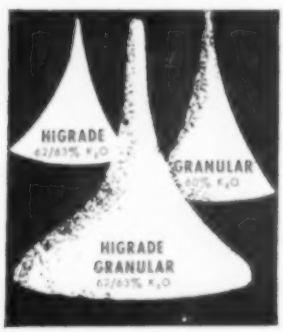
FLORIDIN COMPANY

Adsorbents
Desiccants
Diluents

DEPT. M P.O. BOX 989 TALLAHASSEE, FLORIDA



Better fertilizers begin with three non-caking grades of USP potash



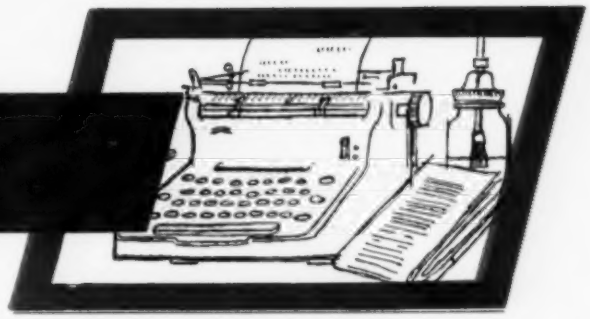
USP's *three* outstanding grades of potash are specially refined to resist caking and remain free-flowing from manufacture to application. And all three are specially sized, too, in perfect grades to meet all modern fertilizer requirements. Two white grades—Higrade muriate and Higrade Granular muriate—each give you more potash per ton (62/63% K_2O) than any other potash available. And USP's Granular muriate (60% K_2O) is ideal for products where a still larger particle size is required.

For complete technical data and shipping information, contact the United States Potash Company. Our expertly staffed Technical Service Department welcomes your inquiries.

UNITED STATES POTASH COMPANY
DIVISION OF UNITED STATES BORAX & CHEMICAL CORPORATION
50 Rockefeller Plaza, New York 20, New York
Southern Sales Office: Rhodes-Haverty Building, Atlanta, Georgia

MEMBER: AMERICAN POTASH INSTITUTE
REG. U.S. PAT. OFF.

EDITORIALS



TO one who still recalls rather vividly the early months of 1929, the current performance of the security exchanges seems vaguely and disturbingly familiar. Then, as now, the nation's economy gave the semblance of being surprisingly healthy. We were assured that we had reached a new plateau of prosperity from which there would be no retreat, depressions were a thing of the past, and stock prices were mounting to higher and dizzier levels, with no particular relation to corporate values or forseeable earnings prospects.

We get the feeling that it could be happening again! History has a way of repeating itself, and many of the same familiar sign posts are again evident. Commodity prices are being held at artificially high levels, in no direct relationship to consumer, as opposed to government, demand. A high percentage of homes are in the hands of householders whose actual equity in them is worryingly thin. The selling price of farm land is out of balance with the returns that can be realized from working the land in the absence of government hand-outs. We have had a long post-war period of boom, relaxing the normal caution of the business community.

And, finally, to get back once more to the stock market, shoe clerks and elevator operators are studying the closing prices as avidly as they do the racing results. "Glamour" stocks, such as the missile shares, electronics, etc. are doubling or tripling in paper value in a matter of a few weeks; and far too many stock buyers are gamblers rather than investors, buying securities to sell at a profit in a few weeks or months, rather than with any view of holding them for the long pull on a yield basis.

The more sober minds in the security markets view this situation with alarm. They are thoroughly familiar with the old truism in "the market", that what goes up can eventually come down, — and often does, with a thud. If and when this happens, there are going to be some bumps and bruises, they fear. It is to be sincerely hoped that when the inevitable correction comes in a run-away stock market, that it will not do serious harm to the financial health of the nation.

WE have been hearing for years how much more fertilizer could be sold if farmers used the quantities recommended by their agricultural advisors. And there is ample evidence available from those who have studied the subject as to the increased yields that would result, and the higher profit margins that might be anticipated.

Finally the industry, through the medium of its trade association, the National Plant Food Institute, has begun a major effort to get its story across to the farm population,—to convince the farmer through a hard-hitting promotion program that he can put more dollars in his own pocket through increased fertilizer use.

The immediate result has been a substantial increase in fertilizer consumption in the area where the new program was first tested. In six counties of Georgia, where NPFI's intensified fertility program had its first test run last season, fertilizer consumption was up more than ten per cent, with plant nutrient consumption up even higher, — seventeen percent over 1957.

We will be very much interested in seeing the follow-up figures, documenting the yield increases and higher profits which can be expected to result from higher rates of fertilizer used in the test area. When all the facts and figures are in, they should constitute an impressive testimonial to the gains that may be anticipated from an efficient fertilizer program.

In March, we published a fine article on "Progress in Granulated Insecticides" (pages 30-31). Unfortunately, however, the author of the paper was not correctly identified. The article was prepared by Ernest L. Gooden, USDA, ARS, Beltsville, Md.

E. D. Burgess, whose name appears in error as author of this article, — was actually the author of another paper, the "Cooperative Federal-State Plant Pest Control Work, (pages 35-36 of our March issue).

THE application of granular pesticides is rapidly increasing in magnitude and diversity. Several agricultural insect control programs of tremendous economic importance now rely principally on granular formulations. These programs include the fire ant eradication project and the control of sugar cane borer, European corn borer and certain subterranean larvae. There are already many other practical and established applications of granular pesticides. Recent technical literature describes an increasing number of promising possibilities for granular insecticides, fungicides, herbicides and soil fumigants.

The purpose of this article is to discuss chemical and physical characteristics of granular pesticides, and some interesting aspects of their successful commercial production. Emphasis is placed on formulations based on granular carriers of Florida-Georgia fuller's earth, known mineralogically as floridin or attapulgite.

The Carrier

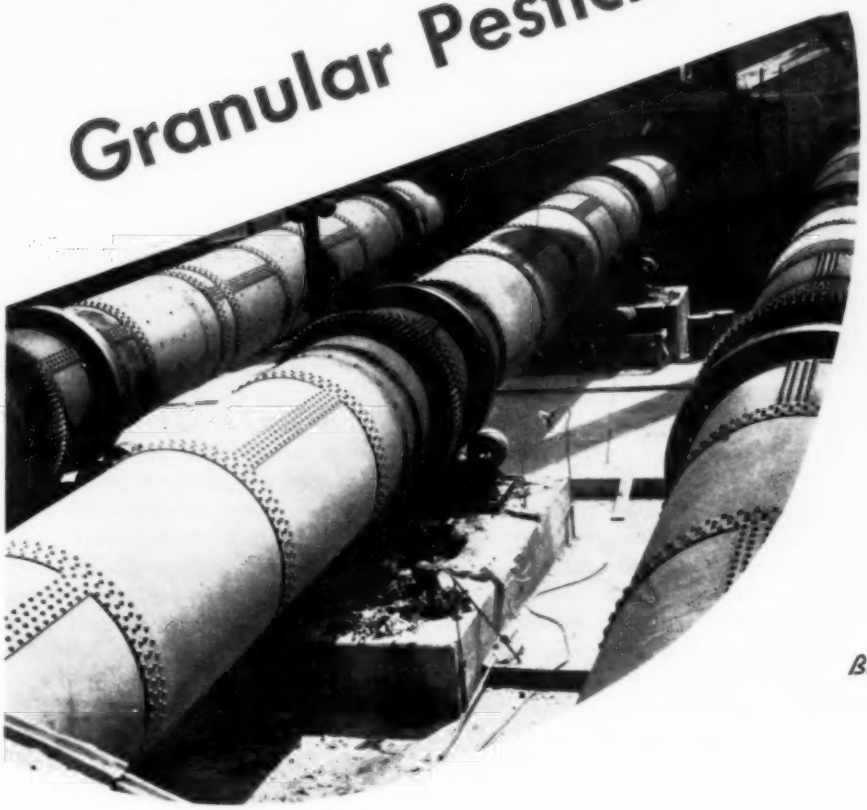
WHATEVER the final product may be, and regardless of how it is processed, it is self-evident that a satisfactory carrier should be used as a starting point. This may not be quite as simple as it seems. The carrier must be commercially available in a satisfactory and uniform size range, free of dust or "fines." It must have sufficient sorptive capacity to take up and hold the active pesticide chemical plus solvents and other ingredients. It must produce adequately stable formulations, either with or without deactivators. It must lend itself to a certain amount of physical handling in transportation, storage and processing without disintegration. Many additional requirements for specific applications are often imposed on the carrier, such as a prescribed amount of particle break-down in water in a given period of time.

Floridin - attapulgite carriers, carefully selected and processed, meet the requirements in the preceding paragraph and because of their high sorptive capacity are used exclusively in certain types of formulations. For example, in the Federal specifications covering 10% heptachlor and 10% dieldrin granular products for fire ant and white fringed beetle control, the attapulgite carrier is mandatory.

In some formulations, it is desirable to have a finished product in which the grains break down fairly readily in water or moist soil or through natural weathering. In other formulations, resistance to physical disintegration is desired. It is interesting and significant that rate of grain break-down in water of attapulgite granules can be controlled in processing. In general, there are two types available: Regular (not calcined) or RVM (regular volatile matter) and Calcined or LVM (low volatile matter). In the latter type, heat treatment in the kilns is carried beyond the point of driving off all free moisture, and some of the combined moisture is driven off, too. Calcining produces a hard granule which resists break-down in water. Apparently, physical disintegration of the RVM particles after application of the finished pesticide in the field accelerates release of the toxicant or at least enhances its distribution.

It has been found that the rate of release of parathion from granules in distilled water and in marsh salt water is more constant with an attapulgite carrier than

Granular Pesticides



Facing page: General view of Floridin Company plant where adsorptive granular carriers are produced.

This page: Kilns in which adsorptive granular carriers are dried and calcined prior to milling and screening.

By Kenneth Krausche
Floridin Company
Tallahassee, Florida

with a montmorillonite or bentonite carrier. In the case of the bentonite carrier, a colloidal gel is readily formed in distilled water, but salt water tends to flocculate colloidal bentonite. Salt water does not have a flocculating effect on attapulgite. This might be a significant factor in control of salt marsh mosquito larvae.

Actual number of particles per pound is significant, and depends on particle size and product density. In field application, the distribution of the pesticide in number of particles per unit area is directly proportional to the number of particles per pound, when the poundage per acre is constant.

It is obvious that for a given carrier, the number of particles per unit weight increases very rapidly as average particle size is reduced. Laboratory determinations and calculations on one commercial type of carrier indicated the following:

mesh	particles/pound
20/40	3,000,000
30/35	3,850,000
35/40	5,200,000
40/60	18,000,000

In some cases, the entomologist is faced with the necessity of a compromise. For optimum mathematical distribution, he would like as many particles per square foot as possible; yet too fine a product would defeat the beneficial purposes of granular formulations. Dust hazards, wind drift and undesirable foliage deposits would increase, while penetration of vegetative cover might decrease.

Recent field and laboratory investigations in fire ant control have indicated that the number of particles per unit area is not as important in the control of this insect as believed previously. Therefore, it is advantageous to employ a somewhat coarser granule, with emphasis on uniformity over a relatively narrow mesh range. An attapulgite carrier, RVM, 20/40 mesh has been a standard carrier for fire ant control formulations and has yielded satisfactory products meeting Federal specifications.

Emphasis in fire ant control is now on uniformity of application of the pesticide in the field, which should be obtained without repeated recalibration and adjustment of application equipment. Uniformity of particle size within a narrow mesh range is a most important factor in gaining this end. Quantity and type of solvent used in the formulation also exert an effect on rate of flow through application equipment under a given set of fixed adjustments. It is hoped that more uniform appli-

*Nominal particle size range is designated by a two-figured mesh classification. For example, 20/40 means that virtually all of the material will pass through a standard 20 mesh sieve (20 openings per linear inch) while only a negligible quantity will pass through a standard 40 mesh sieve.

cation will enable a reduction in average per acre dosage resulting in better control with increased economy and a further reduction in possible hazard or inconvenience to man, livestock and wildlife.

Role of the Solvent

IN the production of granular pesticides, solvents fulfill one or more of several functions. Obviously, solid pesticides, especially those with relatively high melting points, require a solvent as a vehicle for transfer and impregnation into the carrier. The pesticide and solvent are usually heated together in a vessel equipped with steam jacket or coil and the solvent acts as a heat transfer medium. With some pesticides, even a small amount of solvent will reduce viscosity and impede solidification. Pumping through lines is facilitated and clogging prevented. Impregnation is often more complete, and distribution of the toxicant more uniform due to the presence of the solvent.

A series of laboratory tests revealed an interesting relationship between the solvent and the water break-down of granular formulations made with RVM attapulgite as determined by the water break-down test described in Federal specifications. With the carrier alone, the degree of water break-down was only 65% which is not sufficient to fulfill minimum requirements. Formulations containing 10% dieldrin plus 20% heavy aromatic naphtha yielded about 90% water break-down. A determination made on a formulation of 23% of the solvent alone with no dieldrin gave a result approaching 90%. Thus, it is evident an appreciable amount of solvent is necessary to bring about the high degree of water break-down desired in some formulations.

Another beneficial result of adequate solvent application is demonstrated by the fact that when the total amount of material (pesticide and solvents) absorbed by the carrier is close to the point of saturation, the tendency to produce dust or fines in the finished product is reduced. Of course, the unfortunate results of too much solvent are considerably more serious than of using an amount less than the optimum. Too much solvent would produce an undesirable oily material which would not be free-flowing. It is critical that the sorptive capacity of the carrier must not be exceeded.

Sometimes a special solvent is employed for a specific purpose. In the production of 20% or 25% heptachlor granules, the technical heptachlor, Deactivator H and solvent such as heavy aromatic naptha are mixed together in the heating vessel prior to impregnation. All these ingredients are kept mutally soluble, and the system retains homogeniety through the use of a co-solvent. Diacetone alcohol is such a co-solvent in this system. Incidentally, not much of the primary solvent is needed in this particular mixture. It functions as a plasticizer of the heptachlor, helping to smooth out lumps and preventing the formation of pellets where heptachlor may land on the carrier in relatively large droplets.

Not all pesticides require solvents. The soil fumigant, Nemagon, can be impregnated directly into attapulgite granular carriers up to the level of 50% by weight in the finished product.

Processing

THE granular carrier must be handled and processed carefully in order that the finished products will retain desirable characteristics. Most commercial formulators originally tried ribbon blenders because they were readily available in average dust blending plants. Present day standards, especially some of the strict Federal specifications, have virtually eliminated the ribbon blender in good granular pesticide production. The action of the mixer crushes the granules and a large proportion of dust results.

Commercial producers now have returned to the principle employed by some of the very early experimenters with granular pesticides, who used a small cement mixer or hand turned drum mounted in an inclined position and equipped with baffles. The modern installation uses a tumbler blender, which can be either a commercially available standard item of equipment or may be fabricated from a spare cylindrical tank.

Screw conveyors, auger feed valve-packers, and other equipment which would subject the granules to attrition or crushing should not be employed.

In addition to the tumbler blender, a vessel equipped with steam jacket or coil, weigh tank, gear pump, steam traced and lagged lines, impregnating pipe, exit chute and packer with scale complete the usual essential equipment.

In regard to the use of a deactivator for the purpose of stabilizing the formulation and preventing the chemical decomposition of the pesticide, the recommendations of the manufacturer of the toxicant should be followed strictly. As a matter of fact, all the basic chemical manufacturers of standard pesticide chemicals used in granular products have fairly definite recommendations pertaining to specific formulations. The procedures of handling, melting and impregnating, as well as the hazards involved and precautions to be followed in the manufacture of granular pesticides are almost identical to standard procedures in wettable powder and dust base production.

Various stabilizers are employed with different pesticide chemicals when impregnated into sorptive carriers, and these lend themselves to different modes of addition. For example, urea is used with aldrin and dieldrin, and HMT (hexamethylenetetramine) is used with endrin. Both of these materials can be milled to a minus 100 mesh powder and added to the sorptive granular

(*Continued on Page* 129)

Biological Control of Noxious Insects, Weeds

by C. H. Hoffman*
Entomology Research Division
Agricultural Research Service
U. S. Department of Agriculture

THE virus *Borrelina campeoles* has proved effective in controlling the alfalfa caterpillar in California. It can be applied with field sprayers or from airplanes. However, it is difficult for growers to recognize the need for treating in time for the virus to be effective against the fifth-instar larvae, which are the most damaging.

An important recent development is the experimental control of the tobacco hornworm under field conditions in the Carolinas with sprays containing dried spores of the bacterium *Bacillus thuringiensis*. In some tests the spore treatment has proved as effective as endrin, the most effective insecticide. Unfortunately, the spore spray does not control the budworm and other insect pests of tobacco, for which insecticides must still be used. It is impractical for the grower to apply a biological-control agent for one pest and an insecticide for another, if he has an insecticide that will control both species. Several companies are producing this bacterium which shows promise against a number of insect pests. Used in sprays and in granules in field tests it has caused mortalities of 45 to 70 per cent of first-brood corn borers.

Recent tests by this Division in cooperation with the Forest Service have shown that spraying with a water suspension of a polyhedrosis virus on small plots can establish the virus disease in the Great Basin tent caterpillar, which is a serious defoliator of aspen. During the first year the mortality never exceeded 50 per cent, but in the second year it was fatal to almost all the full-grown larvae.

The Entomology Research Division's Insect Pathology Laboratory is one of the Agricultural Research Service's 15 recently established pioneering research laboratories in which insect pathologists are conducting basic investigations in this comparatively new field. Their studies will include the identification of pathogenic organisms, the conditions under which they may cause epizootics in insect populations, and methods of culture for possible practical application.

Conclusion

Higher animals. — Studies by Morris *et al.* (1958) indicate that the effect of birds and mammals on the spruce budworm population during outbreak years has been negligible, the predation of birds being probably less than 1 per cent. They found that birds and parasites responded directly but ineffectually to a rapid and sustained increase in budworm population. Studies should be carried out when populations are low, at which time birds may be of considerable importance in preventing their increase.

Weeds.—The classic example of biological control of a weed in this country is the importation from Australia and Europe of several insects to destroy the Klamath weed. This weed is not only poisonous to livestock but displaces desirable range plants. Chemical control proved expensive and much of the infested land was inaccessible. Two species of *Chrysolina* beetles proved to be specific to Klamath weed, and within two years after liberation they became well established and soon widespread in California, from which they were redistributed locally and to other States (Holloway and Huffaker 1952). In California alone more than 100,000 acres have been returned to useful production, and grateful cattle and sheep growers have recently erected a monument in honor of these beetles.

Plant resistance to insect attack.—Some plants show more resistance to insect attack than others. Either they lack certain qualities that would attract the insects or they possess qualities that may adversely affect the insects' growth or permit the plants to withstand infestations that would severely injure susceptible plants. The development of a new variety involving hybridization followed by selection usually requires six to ten years (Painter 1958). Thus, such an approach to insect control is a long-time venture, but when successful it is of long-lasting value.

The development and release by various experiment stations of seven varieties of wheat resistant to the hessian fly is an excellent example of this type of insect control. Plant breeders and entomologists have developed two varieties, Pawnee and Ponca, which in 1956 were grown on about 60 per cent of the wheat acreage in eastern Kansas, where previously the hessian fly had reduced the crop by about a million bushels each year. When Ponca was grown outside its area of adaptation, it still retained its fly resistance and agronomic value, but millers disliked it because it did not fit into their milling program (Painter 1958).

A number of hybrids resistant to the European corn borer have been distributed in the North Central States. The reduction in in-

festation results primarily during the feeding of the first-instar larvae in the whorl. Research has also shown that borer survival in resistant hybrids isat least 50 per cent less than in susceptible ones. With such a reduction in each generation, it should not take many generations before the insect would become almost nonexistent. Many of the corn hybrids grown in Ohio are resistant to the borer.

The spotted alfalfa aphid, a destructive pest of alfalfa, invaded the western States in 1954, and by the end of 1956 was found in 30 States. An early discovery was that Lahontan, a variety best suited to the irrigated valleys of the intermountain area for which it was developed, had excellent resistance to the aphid. Subsequently varieties Moapa and New Mexico 16 were developed for other areas, and research continues in an effort to find more varieties adaptable to other new areas that may become infested with this aphid.

Irradiation.—One unique new approach to insect control, which is not entirely biological, involves the large-scale release of males sterilized by gamma rays from a cobalt-60 source to destroy the reproductive potential of natural populations of the screw-worm fly. Losses caused by this pest cost livestock men in the Southeast as much as $20 million a year, and there are also large wildlife losses. When a sterilized screw-worm male mates with a native female, she will lay only infertile eggs in the wounds of animals. Therefore, repeated releases of a preponderance of sterilized males gradually decrease the reproductive potential of the natural population and lead to ultimate annihilation. This idea was conceived by E. F. Knipling, director of the Entomology Research Division, and much laboratory and field testing by our research scientists preceded the dramatic eradication of the screw-worm from the island of Curacao in 1954 (Knipling (1957).

After additional research on mass rearing of screw-worms, sterilization of the pupae, and the development of improved devices for releasing the flies from airplanes, a 2,000 square mile field study was conducted that confirmed the practicability of a large-scale control program. In 1957 the State of Florida and the U.S. Department of Agriculture undertook a multimillion-dollar eradication program to free the Southeast of this pest. The Animal Disease Eradication Division of the Department and the State of Florida erected a tremendous fly-rearing facility geared to produce 50 million flies per week. Sterilized flies have already been dropped over about 70,000 square miles in Florida, southern Georgia, and southeastern Alabama. It appears that the natural screw-worm populations have been eliminated in all but two counties in Florida, and prospects are good that this pest will be eradicated from the Southeast.

Because the sterile-male-technique approach to insect control appears promising, preliminary studies are under way in our Division against other insects, including fruit flies, the sugarcane borer, the boll weevil, and mosquitoes.

Research needs.—There is need for further biological and ecological studies on many of the insects injurious to agricultural crops and trees to determine which biological-control agents show the most promise. What are their host relationships, including competition between species, and what influence do weather and other environmental factors have on their effectiveness? These agents must be readily obtainable and provide economic control or they will not be acceptable to growers as replacements for insecticides. Studies are also needed to develop the best integrated program on their utilization to the maximum advantage with a minimum use of insecticides. Explorations should be continued to find enemies of the undesirable insects and weeds from foreign countries which have become established in this country. The possibility of developing improved strains of these natural enemies through breeding or hybridization should be investigated.

A neglected field involves the mass rearing of biological-control agents and an evaluation of wide spread liberations over extended periods of time. The releases or treatments would be similar to an insecticide schedule, and possibly economic control could be obtained under such circumstances. These studies would require the development of economical mass-rearing techniques utilizing suitable hosts, synthetic diets, or artificial culture media. Tissue-culture methods are needed for the propagation of insect viruses and for the production of growth-regulating hormones that might prove useful as insect controls. Regardless of the biological-control agents used, research should be conducted to determine the precise timing required in favorable environments if the organisms are to be effective and available in time to prevent damage by the pest insect. Studies are also needed to determine the underlying causes of epizootics. Ways must be found to hold or store biological-control agents to insure their ready availability.

Studies should be made abroad of insect enemies of noxious weeds already established in the western United States, including halogeton, gorse, Scotchbroom, Dalmatian toadflax, puncture vine, and tansy-ragwort. A tremendous field is open for the development of varieties of crops resistant to insects. It takes a long time to get results in crop-improvement programs of this nature, and perhaps that is the reason such research is poorly supported. Resistant plants sometimes upset the physiology of insects, and studies are needed to determine whether they may thereby become more susceptible to insecticides, diseases, or their enemies. It is urgent that studies be conducted

(*Continued on Page* 135)

'58 Pesticide Output Up 10%
DDT Production Sets Record

A REPORT on pesticide supplies and requirements appearing in the March 1959 issue of *Agricultural and Food Chemistry* indicates that the output of pesticides in 1958 was up ten per cent, due mainly to a record year for DDT output. Stocks of all pesticides on hand at the end of '58 were ten per cent lower than for the previous year, the report added.

Harold H. Shepard, Commodity Stabilization Service, USDA, Washington, D. C., prepared the report and said that the production of synthetic organic pesticides in 1958 amounted to about 575 million pounds. More DDT was made than in any previous year, but the manufacture of 2,4,5-T was somewhat lower in 1958 and the production of calcium arsenate was down to about half the 1957 level. Copper sulfate production fell to below 100 million pounds for the first time since 1939.

Imports of pyrethrum flowers were reported to have been slightly lower than in the previous year, but receipts of extract nearly doubled. Total pyrethrum imports in terms of active principle, therefore, were about 17 per cent above those of 1956-57.

"Prospects for 1959," Mr. Shepard said, "are that new uses will continue to be found for older chemicals, while new compounds will provide pest control where previous materials were ineffective or inadequate. Changes in government imposed crop restrictions for 1959 are expected to favor greater use of pesticides."

Appreciable quantities of the insecticides applied last year were used to fight the largest grasshopper outbreak since 1939. The presence of few winter eggs in many of the treated areas, however, indicates less of a grasshopper threat in 1959.

The value of pesticide exports reported for the 1957-58 crop year was $84,257,493, compared to $85,908,799 in 1956-57 and $80,779,159 in 1955-56.

Regarding DDT, the report said that the "production of DDT through November of last year amounted to 130 million pounds. At that rate the total for 1958 probably reached 142 million pounds, making it a record year. The demands of the foreign malaria eradication program accounted for large quantities, and will continue to do so in 1959. According to latest information, present U.S. rated capacity to produce DDT (172,400,000 pounds, divided among eight plants) is adequate. Contrary to oft-repeated statements that its domestic use has been waning for the past few years, DDT still is employed within the United States in larger quantities than most other pesticides."

The carryover of organophosphates was considerable despite the overall 10 per cent reduction of pesticide stocks on hand, according to the report. Calcium arsenate stocks were half again as high as they were in 1957 and stocks of herbicides also were higher. DDT stocks, on the other hand, along with stocks of grain and soil fumigants were only half as high as they were in 1957.★★

Pesticidal Chemicals: Production by Crop Years

	1955-56 (1,000 lb.)	1956-57 (1,000 lb.)	1957-58 (1,000 lb.)
Aldrin, chlordane, dieldrin, endrin, heptachlor, and toxaphene	80,418	73,911	88,879
Benzene hexachloride (gamma)[a]	13,535	9,376	6,000 (estd.)
Calcium arsenate	26,400	20,360	9,250
Copper sulfate	146,056	143,592	98,421
2,4-D acid	29,000 (estd.)	32,258	32,000 (estd.)
DDT	137,747	129,730	131,862
Lead arsenate	13,250	12,500	not available
2,4,5-T acid	4,501	5,191	4,000 (estd.)

[a] Does not include lindane.
Sources: U. S. Tariff Commission, U. S. Bureau of the Census, and the chemical industry.

Chemical Manufacturers' Primary Pesticide Stocks

Material	1958 Stocks As a % age of 1957 Stocks
Aldrin, chlordane, dieldrin, endrin, heptachlor, toxaprene	96
Benzene hexachloride (gross basis)	81
10-15% gamma grades	79
36% and above, including lindane	87
Calcium arsenate	152
Copper fungicides	133
2,4-D (acid basis, but includes manufacturers' formulations)	144
DDT	43
Fumigants (grain and soil)	54
Lead arsenate	102
Miticides (miscellaneous)	113
Organic phosphorus compounds	177
Includes:	
Methyl parathion	742
Parathion	115
Others	133
2,4,5-T	106
Fungicides (miscellaneous)	80
Insecticides (miscellaneous	121
Weed killers (miscellaneous organic)	256
All primary stocks	89

Conclusion of a 2-part article

Caking of Mixed Fertilizer and its Alleviation—

by Simon Kacygnski
Quimbrasil S/A.—
Sao Paulo — Brazil

WE have studied quantitatively the swelling of fertilizer during the curing process. A hot water bag was filled with the freshly made formula and the density of the whole was measured by immersion in water (Fig. 3). The hot water bag had a hole in its mouth to maintain equilibrium with atmospheric pressure. The density was measured submerging the bag up to a mark on its neck. The weight hanging on the bag prevented the bag from floating when its density became less than 1. The rubber bags were kept at 35°C and the density variation (decrease) was verified after convenient time intervals, obtaining a curve density vs. time. This test gave very uniform results and it seems reasonable that the swelling of the fertilizer varies directly with curing.

From a second test made with the same material, we got a curve of similar shape, but somewhat dislocated, because the initial density depends on the manner of filling the bags and other factors which were not standardized, (Fig. 4). The volume kept increasing for 30 days, but after 20 days, about 90% of the final volume increase had been achieved. This method of observing the fertilizer curing indicated it to be suitable for the determination of the amount of superphosphate which reacts with ammonium sulphate.

As mentioned before, for many authors, the reaction between mono-calcium phosphate and ammonium sulphate determines the caking of fertilizers containing mixtures of these compounds. Our experiments apparently confirm this hypothesis, because we have found that a mixture of superphosphate (straight or triple) and ammonium sulfate cakes strongly, reacts in definite proportions and is accompanied by a physical change (volume increase) similar to that observed in curing of No. 1 formula, (containing KCl); however we do not have any evidence that the calcium sulfate is responsible for caking (could be ammonium phosphate as well).

The free acid of the superphosphate diminishes very rapidly after addition of ammonium sulfate in excess of a certain amount; below this amount, the acidity is not affected by the ammonium salt. (Table IV). The reaction of free phosphoric acid on the remaining insoluble calcium phosphate producing soluble mono-calcium phosphate (Ca-ions) is very slow. Possibly after addition of enough ammonium sulfate, sulfate ions from this salt combine with the dissolved calcium ions to form insoluble calcium phosphate, taking away the Ca-ions. Thus the reaction, which consumes the free acid, is stimulated.

Figure 3 — Arrangement for measuring density variations in a mixed fertilizer. The filled bag is weighed in air, and then immersed in water.

Figure 4 — Variation of the density during the cure of a fertilizer mixture (ammonium sulfate 20%—potassium chloride 10% — superphosphate 70%).

Reaction Between Superphosphate and Ammonium Sulfate

THE amount of ammonium sulphate which reacts with a certain amount of superphosphate to yield a mixture without reactivity to either superphosphate or ammonium sulphate is, besides its theoretical interest, also of practical importance. Knowing these amounts, it is possible to prepare a "cured neutral mixture" which could be used in the formulation and direct bagging of mixed fertilizers, without danger of caking from this cause. Some years ago, Quimica S/A produced mixed fertilizers starting from a cured and

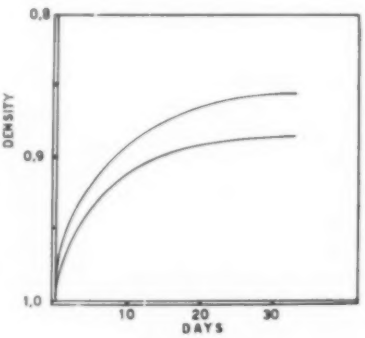


FIG.4

Table III. Influence of Water on the Caking Tendency of a Mixed Fertilizer.

No. 1 Formula: (4-15-6): Ammonium Sulfate 20% — Potassium Chloride 10% — Superphosphate 70%.

Bulk Curing	Crushing Strength (PSI) Using Plain Superphosphate (7,3% free water)	Using vacuum dried superphosphate (0,9% free water)	5% water added
1 week	9,7	20,1	7,1
2 week	8,3	12,2	8,8
3 week	8,9	7,2	3,3
4 week	12,8	35,6	5,2
5 week	9,4	12,1	4,2

Table IV. Influence of Amount Sulfate Added to Superphosphate, on the Acidity of the Mixture (free acid as P_2O_5 of the Superphosphate Used: 3,2%. Curing Time: 25 Days).

Parts of Ammonium Sulfate	Parts of Superphosphate	Free Acid
4	100	3,6%
6	100	3,6%
8	100	3,6%
10	100	3,4%
15	100	2,9%
25	100	0,9%
35	100	0,8%

ground mixture of superphosphate-ammonium sulphate 75:25, (arbitrarily chosen by addition of KCl, superphosphate, ammonium sulphate, etc., which were bagged immediately after mixing.

Our first attempt to determine the amount of ammonium sulphate which reacts with a given amount of superphosphate was the following:

With superphosphate analyzing:

P_2O_5 total	22.0 (A.O.A.C.) (2)
P_2O_5 citrate soluble	19.8 (A.O.A.C.) (2)
P_2O_5 water "	18.0 (A.O.A.C.) (2)
Free acid, as P_2O_5	3.9 (by acetone extraction) (6)
SO_3	31.1
CaO	29.8

3 mixtures were made:

A) —Containing 94% $(NH_4)_2SO_4$

B) —Containing 150% $(NH_4)_2SO_4$

C) —Containing 60% $(NH_4)_2SO_4$

After 25 days "pile curing", we tested the three samples for caking after admixture of 5% $(NH_4)_2SO_4$ to each. The tests showed that the "B" mixture was closer to the "cured neutral mixture" than the other two.

To obtain a more accurate value for the composition of the cured neutral mixture (equivalence point), we adopted the following hypothesis: By addition of increasing amounts of ammonium sulfate to a certain quantity of superphosphate, the final volume increase (swelling) on curing, should be in a certain sense proportional to the amount of ammonium sulfate added, up to the equivalence point; after this, the further addition of ammonium sulfate would not result in additional volume increase. We made samples, containing for 100 parts of superphosphate respectively 4-6-8-10-15-20-25-30 parts of ammonium sulfate. In Fig. 5 we have plotted volume increase vs. time. The sample containing 4 parts was not considered, because it did not cake. In Fig. 6 we drew isochronous curves, plotting parts $(NH_4)_2SO_4$ added vs. volume increase. The equivalence point is quite close to 12.5 parts ammonium sulphate for 100 parts superphosphate. A similar experiment, (Fig. 7) made with triple superphosphate and ammonium sulfate, showed that in this case the equivalence point is about 29 parts of ammonium sulfate for 100 parts triple.

(*Continued on Page* 131)

Figure 5 — Volume increase plotted vs time in the seven sample, containing respectively, 6-8-10-15-20-25-30 parts ammonium sulfate for 100 parts superphosphate.

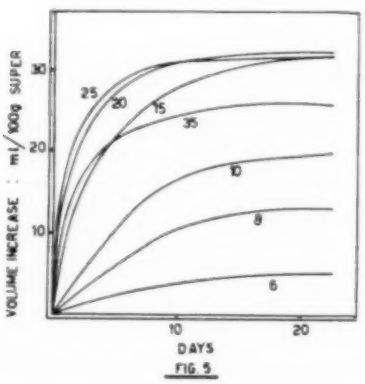


FIG. 5

Figure 6 — Isochronous curves, plotting parts $(NH_4)_2SO_4$ added to superphosphate vs volume increase, after 5-10-22 days cure.

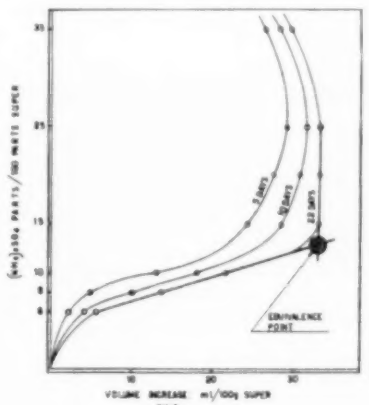


FIG. 6

Figure 7 — Isochronous curves, plotting parts $(NH_4)_2SO_4$ added to triple superphosphate vs volume increase, after 15 and 36 days cure.

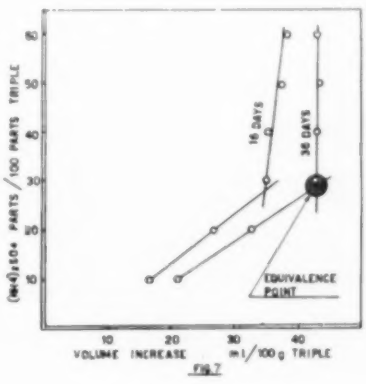


FIG. 7

Endothal

INCREASING attention to development and uses of "pre-emergent" chemicals for weed control has resulted in some interesting studies and applications. One such recent development has been the use of endothal for weed control in beets and spinach. A brief resume of this chemical and its development for pre-emergent uses is given.

Endothal was first discovered to have biological properties in 1948 in a screening program for pesticides. Like many new agricultural chemicals, it was synthesized originally for trials for another use which, in the case of endothal, was a nematocide, but subsequent tests on plants soon revealed its herbicidal properties[1].

Described chemically, endothal is 3,6-endoxohexahydrophthalic acid. Use of this chemical is confined to the sodium salt which is correctly referred to as disodium endothal. However, the name disodium endothal has been shortened to endothal. Accordingly, the shortened name is used in this paper to refer to the water soluble derivative. Many other derivatives of this structure have been evaluated, but none have been found to be higher in herbicidal activity than the sodium salt.

Two main types of herbicidal activity have been developed for this compound. One is defoliant and desiccant properties, which have already been demonstrated on a wide variety of crops. For this use, the sodium salt has been formulated in water (with an activator) as a "harvest aid." It has been used successfully for several years to defoliate such crops as cotton, ramie, rose and apple nursery stock and alfalfa, and experimentally for desiccation on seed crops such as clover, corn, and rice.

The second main type of activity for which endothal possesses unusual properties is for the control of weeds by application to the soil before the emergence of the crop plant. It became evident in early tests that this material was effective on a broad spectrum of weeds and many grasses. Some of these are listed in Table I. The liquid formulation "weed killer" which has been successful in weed control on field crops is a water solution containing two pounds of endothal per gallon and applied as a spray during the planting season. Another endothal formulation, a "turf herbicide," is now being used for the control of Veronica, annual grasses, and certain broad leaved weeds on golf courses and lawns.

It also became evident in early experimental work that certain crops were not susceptible to the herbicidal action of endothal. Beets and spinach were found to be able to tolerate doses which would kill weeds in pre-emergent applications and, in some instances, with post-emergent treatments. Accordingly, experimental work by many experiment stations and other independent agencies has been in progress for several years

TABLE I
Weeds Known to be Sensitive to Endothal in pre-Emergent Applications

Common Name	*Latin Name*
Smart Weed	*Polygonum pennsylvanicum*
Knot Weed	*Polygonum aviculare*
Wild Buckwheat	*Polygonum convolvulus*
Purslane	*Portula oleracea*
Pig Weed, Red Root	*Amaranthas retroflexus*
Henbit, Texas Blue Weed	*Lamium amplexicaule*
Green Foxtail, Pigeon Grass	*Setaria lutescens*
Speedwell	*Veronica* sp.
Kochia, Mexican Fireweed	*Kochia scoparia*
Dock	*Rumex* sp.
Ragweed	*Ambrosia* sp.
Clovers	*Trifolium* sp.
Vetch	*Vicia* sp.
Poa	*Poa annua*
Annual and Perennial grass seedlings	Various
Nimblewill	*Muhlenbergia schreberi*
Cheat	*Bromus* sp.
Wild Oats	*Avena fatua*

*Major contributions to this article are acknowledged of Messrs. Alvin G. Ash, Harold L. Lindaberry, and Edward J. Bowles, all of Pennsalt's Agricultural Chemicals staff.

Figure 1 — Cultivation of beet fields treated with endothal weed killer. Note control with hand weeding unnecessary.

Courtesy of Great Western Sugar Co.

Figure 2 — Applying endothal weed killer. Note spray nozzle is attached just forward of tiller wheel.

Courtesy of Howry-Berg Steel & Iron Works

Figure 3 — Weed control in band treatment of row with endothal weed killer.

Courtesy of Great Western Sugar Co.

weed killer for beets

*by Harold J. Miller**

Pennsalt of Washington Division
Pennsalt Chemicals Corporation

Herbicide	Pounds Actual Endothal/Acre	% Control (of check) Texas Blue Weed (Lamium amplexicaule)	Stand No. per foot of row

Table 2: Weed Control in Red Beets Pre-emergent Applications (Texas, 1953)

Endothal	4	92.7	13.4
Endothal	8	97.2	14.2
Endothal	12	99.5	18.0

Table 3: Weed Control, Sugar Beets—Pre-emergent Application Followed by Sprinkler Irrigation. Weed Counts Just Before Thinning (Longmont, Colorado, 1955)—Data in Per Cent of Check

		Beets		Small Seeded Grasses		Broadleaved Weeds	
		Broadcast	Band	Broadcast	Band	Broadcast	Band
Endothal	6	76	83	8	15	9	29

Note: Band treatment was at ¼ rate of actual endothal per acre

Table 4: Weed Control in Sugar Beets (Billings, Montana, 1958)—Data in Number per

	(Beets (singles)	Grassy Weeds	Broad Leaved Weeds
Endothal 6	20 per 100 feet of row	.3 per 10 feet of row	1.3 per 10 feet of row
Check 0	20 per 100 feet of row	7.0 per 10 feet of row	12.0 per 10 feet of row

Table 5: Weed Control, Sugar Beets Pre-emergent Applications (Wyoming, 1956)

		% Control (of check)		Beets	
		Grass	Broadleaf	% Stand	Tons/A	% Sugar
Endothal	6	69	72	99	23.6	18.5
Check					20.0	17.5

Table 6: Weed Control—Sugar Beets—Pre-emergent Applications (Hardin, Montana, 1958)

Hand Weeded Check	0	40.5% Tare	13.16 Tons/Acre
Endothal (6-in. band)	2	31.8% Tare	16.45 Tons/Acre

Table 7: Sugar Beet Weed Control (North Platte, Nebraska)—Data in % Stand Reduction (of check)

		Grass	Broadleaf	Beets
Endothal-liquid	6	92.7	69.3	3.3
Endothal-liquid	8	96.0	89.0	3.0
Endothal-granular	6	93.3	97.0	.66

for the development of weed control on these two types of crops, with the result that endothal is accepted for use on these crops.

Endothal weed killer has been used successfully in pre-emergent applications on red beets. Typical results are summarized in Table II from work by the California Packing Corporation[2]. Other favorable results have also been reported by Noll[3]. For use on spinach, two to four pounds of active ingredient has given satisfactory control of weeds which appear in the Fall plantings in many areas[4]. Band applications can be used also on this crop. Considerable experimental work is still in progress.

Typical results of the use of endothal weed killer in the control of weeds in sugar beets are given in Tables III and IV, which were obtained by Dr. Russell Nelson of the Great Western Sugar Company Experiment Station[5] where treatments were followed by sprinkler irrigation. Also, similar effective control in sugar beets is shown in Table V in data obtained by Dr. Harold Alley at the University of Wyoming[6] in 1956 and by Mr. R. K. Bischoff[7] of the Holly Sugar Corporation in Table VI. Figure 1 illustrates the effective control of both broad leaved weeds and grasses with no effect on the beet crop.

Since endothal was found to persist for only a relatively short period of time in the soil, it became apparent that for maximum herbicidal activity to be obtained, it would be necessary to obtain better distribution of chemical in the layer of soil where the germination of weed seeds occurs. This has been accomplished by sprinkler irrigation or mixing endothal with the soil with a special tiller machine such as that illustrated in Figure 2. Adequate soil moisture at the time of treatment is important for best control. Since endothal is a water soluble compound, it is necessary to avoid excessive irrigation, as

(*Continued on Page* 126)

38 plants...for prompt delivery of AA quality products

38 plants of the A.A.C. Co., located in the United States, Cuba and Canada, with main office in New York, assure you dependable, fast deliveries of AA quality products for farm and industry. You can schedule your production with confidence . . . the right quantity and grade will be at your plant when you need it.

for uniform quality, prompt delivery and technical service . . . order from

The
American Agricultural Chemical
Company

producers of:

Florida Pebble Phosphate Rock • Superphsophate
AA® QUALITY Ground Phosphate Rock
All grades of Complete Fertilizers • Keystone® Gelatin
Bone Products • Fluosilicates • Ammonium Carbonate
Sulphuric Acid • Phosphoric Acid and Phosphates
Phosphorus and Compounds of Phosphorus

THE AMERICAN AGRICULTURAL CHEMICAL COMPANY
AA QUALITY

GENERAL OFFICE: 100 Church Street, New York 7, N.Y.

About Fungicides . . . .

Concluding installment of a two-part article which reviews some of the basic information on fungicides of interest to the dealer, salesmen,—any newcomer to agricultural chemicals industry.

by S. E. A. McCallan
Boyce Thompson Institute for Plant Research, Inc. Yonkers, New York

Mercury Fungicides

THERE are two types of mercury fungicides, the inorganic mercuric chloride (corrosive sublimate) and mercurous chloride (calomel), and the various organic mercury preparations. The former group have been employed for seed treatments, tuber dips, etc. However, their use has been largely replaced by the organic mercury preparations which are less toxic to plants and often more effective. In addition to the above applications, the organic mercury compounds are also used effectively in early season fruit sprays, especially against apple scab (these are primarily the phenyl mercury compounds), on ornamentals and on turf. Since there is a bewildering array of these compounds which depend primarily on mercury for their action, and which have no common names, the various differences in the chemistry of the active ingredients will not be given. Some of the trade names are Agrox, Ceresan, Emmi, Gallotox, MEMA, Panogen, Phix, PMA, Puraseed, Semesan, Setrete, and Tag. Various formulations of these may be indicated by appended numbers or names.

Cadmium, a chemical element, somewhat similar to mercury, has had limited use in both inorganic and organic form to control turf diseases.

Organic Fungicides

FOR a long time the only fungicides were those containing sulfur, copper, or mercury and formaldehyde (or formalin) which was used as a seed or soil treatment. However, about 20 years ago industry and the agricultural experiment stations became interested in organic fungicides. As the result of a vast amount of cooperative research we now have a number of highly effective organic fungicides which generally do a much better job than the old inorganic ones. This interest holds at a high level and a continued output of new materials can be expected.

Dithiocarbamates. Of all the organic fungicides, the dithiocarbamates are by far the most versatile and widely used, being employed as foliage sprays and seed and soil treatments. They were also the first of the new organic fungicides. All of these theoretically may be derived from dithiocarbamic acid, hence the group name. There are 6 important ones: thiram, ferbam, ziram, nabam, zineb and maneb. Thiram (tetramethylthiuramdisulfide or preferably bis(dimethylthiocarbamoyl) disulfide) is successfully used as a seed treatment e.g. Arasan; lawn or soil treatment e.g. Tersan; and as a foliage spray e.g. Thylate. Ferbam (ferric dimethyldithiocarbamate) is a black powder and widely used as a foliage spray, especially on apples. It is also effective against rust diseases and diseases of many ornamentals. Some trade products were mentioned above. A closely related compound is the zinc salt ziram (zinc dimethyldithiocarbamate) used especially on tomatoes and other vegetable crops; examples are Corozate, Karbam White, Methasan, Zerlate and Zirberk. Nabam, maneb and zineb are respectively the sodium, manganese and zinc salts of ethylenebis[dithiocarbamate]. Nabam is a foliage spray which has attained outstanding success on potatoes where it has markedly increased the yields. Since nabam is unstable it must be applied more frequently than the copper fungicides. Marked improvement in stability and performance was made with the discovery that the addition of zinc sulfate would impart these properties. Well known commercial products are Dithane D-14 and Parzate Liquid. Zineb is essentially factory-prepared nabam plus zinc. It is a general-purpose foliage fungicide especially useful on potatoes and tomatoes. Some well-known commercial preparations are Dithane Z-78 and Parzate. Maneb has much the same uses as zineb; trade products are Dithane M-22 and Manzate.

Other Organic Fungicides. The second group of organic fungicides to be developed were two quinone compounds: chloranil (tetrachloro-*p*-benzoquinone) and dichlone (2,3-dichloro-1,4-naphthoquinone). Chloranil is a seed treatment material, especially good on peas, lima beans and other legume seeds. The commercial preparation is Spergon. Dichlone is primarily a foliage spray but has been used as a seed treatment and soil drench; it is sold as Phygon.

Glyodin (2-heptadecyl-2-imidazoline acetate) is an organic fungicide with a successful specialized use as an apple scab and cherry

leaf spot spray. The industrial product is Crag glyodin.

Captan (*N*-(trichloromethylthio) - 4 - cyclohexene - 1,2 - dicarboximide) is one of the newer established fungicides. It is finding many applications as a foliage spray, particularly on apples; also captan is used for seed treatments and as a dip for tubers and cuttings, etc. Commercial preparations contain the name Captan or Orthocide.

For a long time there was no fungicide really very effective in controlling the powdery mildew diseases, as sulfur was only partially effective. It now appears that Karathane or Mildex, foliage fungicides, fulfill this need at least in part. There is as yet no common name. The active ingredient is 2-(1-methylheptyl)-4, 6-dinitrophenyl crotonate; on labels this is often shortened to "dinitro capryl phenyl crotonate."

In addition to the organic mercury seed treatments there are the organic compounds, hexachlorobenzene and pentachloronitrobenzene. Some trade names of the former are Anticarie, No Bunt, Sanocide and the latter PCNB and Terraclor.

Phenol compounds are used extensively in industry as disinfectants and wood preservatives, but in agriculture they are generally too toxic. However, for dormant sprays in orchards when the trees are bare and for ground cover sprays to kill the fungi overwintering on dead leaves, the so-called dinitro or DNC sprays are in general use. A common active ingredient is sodium 4,6-dinitro-*o*-cresoxide present in such products as Dinitro Dry, Elgetol, and Krenite.

Among the many experimental fungicides which may become of commercial importance one in particular should be mentioned. Cyprex (active ingredient-*N*-dodecylguanidine acetate) has been especially promising in the control of apple scab as well as other foliage diseases. The tendency to damage foliage sometimes may be corrected with improved formulation. Another experimental foliage fungicide is Dyrene (2,4-dichloro-6-(chloroanilino) triazine), here there is also the question of phytotoxicity.

Soil Treatments. The soil fungicides and nematocides to control soil nematodes may be considered together. Many of these require special applicators or machines to inject them into the soil. Also most have a high vapor pressure and give off dangerous fumes. The first known soil fungicide was probably formaldehyde, now largely outdated. Chloropicrin (trichloronitromethane) was shown to be very effective in killing not only fungi and nematodes but also soil insects and even weed seeds. However, because chloropicrin is expensive, and is a tear gas and hence difficult to handle, it has lost much of its popularity with the development of newer and easier to handle materials.

Other established soil fumigants, somewhat less toxic, are methyl bromide and allyl alcohol. Among the most widely used ones are ethylene dibromide (e.g. Dowfume W85) and various dichloropropenes and dichloropropanes (e.g. DD Mixture, Dorlone and Telone). Some newer compounds are 1,2 dibromo-3-chloropropane (Nemagon), sodium *N*-methyldithiocarbamate (Vapam) and 3,5-dimethyl - 1,3,5,2H-tetrahydrothiadiazine-2-thione (Mylone). It should be realized that some of the materials mentioned above as seed treatments, such as the organic mercury compounds and pentachloro-nitrobenzene, are also used as mild soil fungicides.

Antibiotics. Unlike all the above organic fungicides which are artifically synthesized, the antibiotics are produced by microorganisms including fungi. However, they are still organic chemical compounds, though for the most part the exact chemical nature is not yet known. For a number there are common names.

As is well known, the antibiotics have given marvelous control of many human infections and diseases. Their use as plant pesticides is as yet very limited and still largely in the experimental stage. They have shown the greatest promise against bacterial diseases, the outstanding example being the use of streptomycin against apple and pear fire blight. Streptomycin as well as other antibiotics such as cycloheximide (Actidione) and oxytetracycline (Terramycin) have controlled various bacterial diseases under qualified conditions. Cycloheximide has also given good control of the fungus leaf spot of cherry. A mixture of streptomycin and oxytetracycline (Agri-mycin) has shown very promising results in the control of a number of diseases. Many antibiotics tend to be phytotoxic or injurious to foliage, so to date the use of antibiotics must still be considered experimental, though most interesting.

Specific Information

THE foregoing discussion has attempted to give the dealer a general background of technical information on fungicides which it is hoped will be helpful in gaining an over-all picture.

However, the dealer's actual problems will be very specific ones, for many users of fungicides from the large grower to the backyard gardener depend on him for advice. Thus the apple grower might well ask his opinion of some of the newer organic fungicides. Again, a housewife will want to know what is the best spray for the mildew on her roses. It is impossible in an article of this type to anticipate and answer the hundred and more common questions that might be asked. The kind of questions, of course, will vary from locality to locality, but, more im-

(*Continued on Page* 131)

Fast, low-cost method for applying sodium chlorate. All you need is a sprinkling can to apply sodium chlorate as dry crystals or in solution to rid any area of weeds. This technique would, of course, be useful for small areas or "spot" treating. Large scale treatment involves the use of specially designed spreaders or sprayers which are readily available.

Full-time Hooker agronomists are ready to help you with weed control plans and to advise you on handling, storing, and using sodium chlorate.

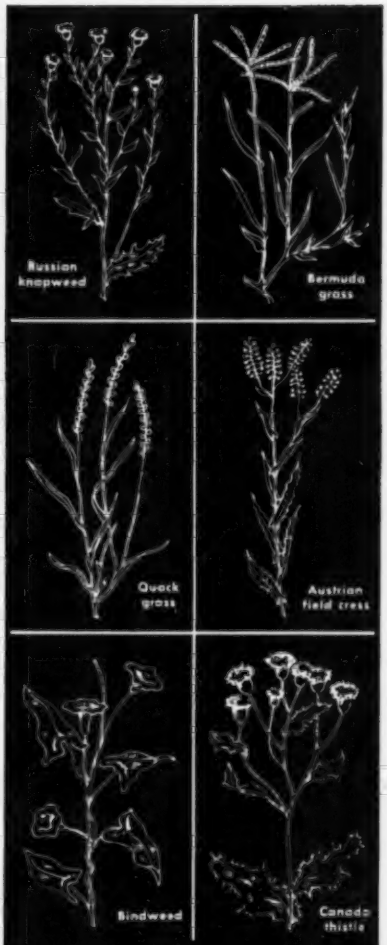
Sodium chlorate plant to be expanded for third time in five years. You'll have no trouble getting sodium chlorate this year or next. We are in the process of expanding our Columbus, Mississippi plant again.

This is the third million-dollar expansion since the plant opened in 1954. It boosts production to more than double the original capacity.

If and when the demand for sodium chlorate starts once more to approach our ability to supply, we'll certainly have another such expansion to insure that you get prompt delivery of Oldbury® sodium chlorate when you need it.

New open-head drum empties faster. Oldbury sodium chlorate now comes to you in this easy opening drum. A single lever seals and reseals the drum with a metal band. You get the full open head to work with too. This replaces the old, four-lug drum in both 100 and 400-lb. sizes.

Write for specifications and helpful bulletin on Oldbury sodium chlorate.



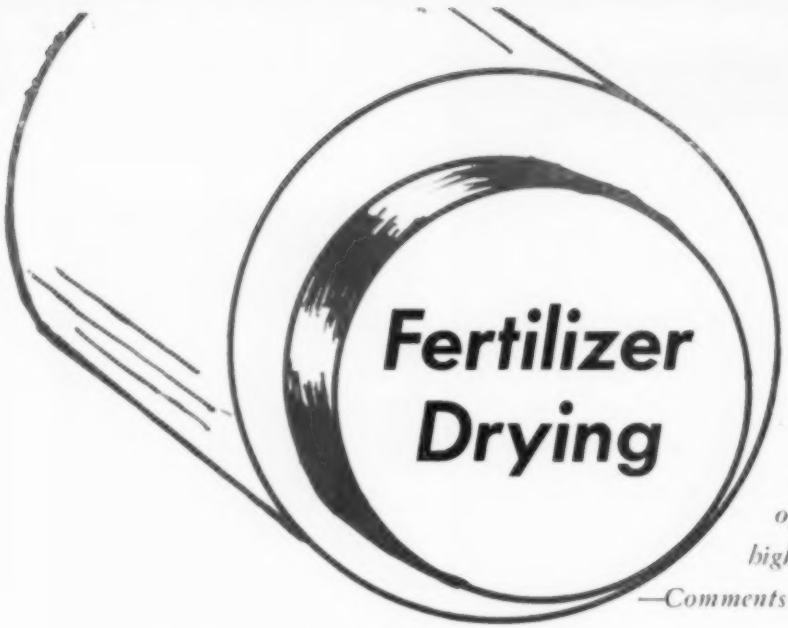
25¢ per 100 sq. ft. kills them all. Sodium chlorate is still your most inexpensive material for all around weed control.

Just 25¢ per 100 square feet keeps land completely clear of weeds . . . no matter how sturdy or tenacious they are. Oldbury sodium chlorate sterilizes the soil completely for one and even two years.

HOOKER CHEMICAL CORPORATION
604 BUFFALO AVENUE, NIAGARA FALLS, NEW YORK

Sales Offices: Chicago • Detroit • Los Angeles • New York
Niagara Falls • Philadelphia • Tacoma • Worcester, Mass.
In Canada: Hooker Chemicals Limited, North Vancouver, B.C.

HOOKER CHEMICALS PLASTICS



— a discussion on the possibility of drying at low temperatures with high retention time in a gas-fired dryer. —Comments on cost factors and furnace design.

By George E. Lang
Edw. Renneburg & Sons Co.
Baltimore Md.

THE question of drying temperature is best explained by a comparison of two examples: Assume a 20 TPH granular fertilizer plant with a 1 to 1 recycle.

The material will enter the dryer at 12% moisture and 130 degrees F. and discharge from the dryer at 1½% moisture. The material will discharge from the dryer at approximately 220 degrees F. and the exhaust gases will exit at approximately 270 degrees F. in both cases:

This means that about 8500 lb./hr. moisture is to be removed and it will require 11.5 million BTU/hr. *net* heat input to the dryer to do this evaporating job.

Now with what we consider the maximum desirable dryer inlet air temperature of 1000 degrees F. for parallel flow drying and the previously mentioned 270 degrees F. dryer exhaust gas temperature we require 20,000 cfm of air measured at 270 degrees F. This is the net amount of air to do the best heat conveying job.

The dryer radiation loss under these conditions would be 1,130,000 BTU/hr. and the stack loss would be 3,150,000 BTU/hr.

This results in a gross dryer heat input of 15.7 million BTU/hr.

The fan to exhaust the drying air and moisture vapors would require a 50 hp. motor, actually drawing approximately 42 hp. The rotary dryer would require a 30 hp. motor, actually drawing approximately 23 hp.

Let's assume we wish to do the same drying job with a 700 degree F. dryer inlet air temperature. The net drying heat requirement would be the same since the same amount of moisture is being evaporated and the fertilizer and exhaust gases are exiting at the same temperatures. We would require now, however, 34,000 cfm at 270 degrees F. as the net amount of air to do this heat conveying job. The dryer radiation loss under these new conditions would be 830,000 BTU/hr. and the stack loss now would be 5,350,000 BTU/hr.

This results in a gross dryer heat input of 17.6 million BTU/hr.

A fan, three sizes larger than previously would be required and a 60 hp. motor would be necessary to drive it, actually drawing approximately 58 hp.

The rotary dryer would require a 40 hp. motor, actually drawing approximately 36 hp.

Summarizing we find an increase of 1.9 million BTU/hr. or 1,900 cfh of an average natural gas or 13.5 gph of fuel, an increase of 13 actual dryer h.p., an increase of 3 fan sizes with an increase of 16 actual fan h.p.; and with the most costly increase being in the larger dust collecting equipment that is required.

The larger equipment, with the exception of dust collecting equipment, would cost approximately an additional $3,000.00 and the increased utility cost would be approximately (10) cents per ton of product.

Particles which travel through the feed chute and the dryer in normal time contribute very little to the fume generation problem. These particles as in the two cases mentioned are not expected to reach a body temperature of over 220 degrees F., which is necessary to reach the desired moisture removal in practical production. On the other hand particles which stay permanently or for a considerable length of time on feed chutes and dryer feed flights and are eventually raised to near 700 degrees F., the latter of the two previous cases, will generate all the fumes that particles raised to near 1000 degrees F. will generate.

In simple tests at our plant in a closed room—small samples of an average grade granular fertilizer were brought to varying body temperatures starting at 200 degrees F. From 200 degrees F. to 300 de-

*This discussion on drying fertilizers was presented at the Fertilizer Industry Round Table, November 5-7, 1958, Mayflower Hotel, Washington, D. C.

Sohigro® UREA gives fertilizer sales a real growth boost

INDUSTRY figures for the 12 North Central States show a 30% boost in the use of nitrogen in fertilizer materials with an increase in higher nitrogen complete fertilizers — 1-1-1, 2-1-1 and even 3-1-1 ratios — during the past year. But if mixed fertilizers don't supply all the nitrogen your customers need, meet the demand by stocking Sohigro Urea. Sohigro Urea supplements mixed fertilizer sales with profits from plow down, top dress, or side-dress sales.

Sohigro Urea gives you more selling advantages than any other nitrogen fertilizer. Prilled, free-flowing Sohigro is non-caking . . . easy to apply. Important, too, Sohigro delivers more nitrogen grow-power (45% actual nitrogen) than any other solid nitrogen fertilizer. Sohigro Urea is all-ammonia nitrogen . . . fast-acting, yet long-lasting.

Cash in on the trend to increased use of high-nitrogen materials by stocking Sohigro Urea now. Call the "Man from Sohio" for details on fast, efficient delivery by rail or truck, or plant pickup at Lima. Inquire also about the savings by handling Sohigro Urea in bulk, especially for custom application.

See Sohio first for high-quality 45% or uncoated 46% urea — anhydrous ammonia — aqua ammonia — 18 nitrogen solutions, including all urea types.

SOHIO

. . . we're serious about SERVICE at Sohio

SOHIO CHEMICAL COMPANY

FORT AMANDA RD., P. O. BOX 628 • LIMA, OHIO

Phone CApitol 5-8015 or wire (TWX call letters LM-497)

8-59

grees F. no appreciable amount of smoke was generated; however, at 300 degrees F. and above increasingly greater amounts of smoke were generated. Another small sample was held about a foot over an electric hot plate and in a very short period of time, before the average body temperature had reached 200 degrees F., the particles facing the radiant heat were producing a terrific amount of smoke. This heavy smoking fell off rapidly after the hot plate was turned off and the radiant glow left the element.

This simple experiment and our experience in the field proves the need for an answer to the third question "How can a furnace be designed to reduce the potential for formation of fumes due to overheating of fertilizer granules." The one basic answer, which isn't always easy to accomplish is to design a combustion chamber and burner system which produces as little luminous radiant heat as possible in both the flame and the refractories, and design the furnace so that whatever luminous heat source is employed, this source cannot "see" surfaces that convey material or material itself which is slowed in its travel through the dryer by sticking. This again is not always the easiest thing to accomplish.

an hour furnaces. Luminous flames are second only to refractories as a source of radiant heat.

Surface temperatures on the outer-surface of the combustion chamber's inner shell don't exceed 500 degrees F. at maximum fire with correspondingly maximum air throughput.

In the last three years' production of these furnaces we have not used anything but $\frac{3}{8}$" thick carbon steel feed chutes and all of these original feed chutes are still in operation. This to us, in comparison with the life and chute design necessary in refractory lined furnaces, is conclusive proof of the extremely abusive nature of luminous radiant heat.

Concluding, it is evident that lowering the dryer inlet air temperature some 200 to 300 degrees F. below an optimum of 1000 degrees F., with no regard for the radiant heat output of the furnace, would give no noticeable fume generation reduction. Lowering the inlet air temperature below this, we question whether it would be economically feasible.

From an economic and operational standpoint the effort to improve fume conditions should be put into the design of the furnace. This would not require any increased continuing utility cost as in the cost of the lower inlet air temperature. In the case of the gas-fired furnaces without refractories, the overall furnace and burner cost is less than the conventional refractory lined furnace, and in the case of oil fired furnaces the cost of multiple burners to provide smaller, shorter flames may be neglible.

Since the combustion of oil is not as satisfactory as gas in the absence of hot refractories, the conventional refractory lined furnace is still the most satisfactory. It should be sufficiently large in volume and the drying air should flow uniformly distributed across the furnace cross-section. All of this air should travel the full length of the furnace and the hot gases, where the dryer is large enough in diameter, should enter the dryer through a beeching where these gases would not envelope the material feed chute.

Formation of fumes in manufacturing fertilizer is, of course, due to overheating; — Solving the problem of fumes is approached in this discussion from the standpoint of drying at lower temperature, — and by a more satisfactory and suitably designed furnace.

I would like to cite our own experience as an example of the economic and operational value of practically eliminating luminous radiant heat.

One of our products is a gas-fired, air-cooled furnace which uses no refractories or insulation whatso-ever. Refractories are the greatest source of luminous radiant heat.

The burners are of a type which break down the conventional large yellow ball of fire into many small blue, almost transparent, flames ranging from 6" long up to 30" long for 30 million BTU

BOOK REVIEW

Fundamentals of Soil Science, 3rd Edition by C. E. Miller, L. M. Turk and H. D. Foth—Michigan State University. Publishers: John Wiley & Sons, Inc., New York. 1958. $7.75. Reviewed by *Vincent Sauchelli.*

A third edition, completely revised, of an excellent text on soils. Emphasis is on basic principles of soil science. The authors are members of the staff at Michigan State University, and senior author, C. E. Millar, deceased, provided much of the text of the earlier editions. In the preparation of this book the authors kept the student in mind. Their exposition of the principles of soil structure, fundamental relationships between soils and plants and the principles underlying good soil conservation practices is aimed at the student in a way to help him develop an understanding of why these concepts are significant in agriculture.

New material comprises studies on the role of clay in the accumulation of organic matter, liquid fertilizers and the relationship of pH to percentage of base saturation.

This book is recommended to all those who are interested in acquiring a sound knowledge of the most important concept of the modern science of soils. Each chapter contains a series of questions which reveal experience in the classroom with students and knowledge on how to lead them to think constructively about the subject matter.

Formulating Granulated Mixed Fertilizers with Nitrogen Solutions

Containing Urea, Ammonium Nitrate and Hydrous Ammonia

This review on the use of nitrogen solutions containing urea, ammonium nitrate and anhydrous ammonia in granulated mixed fertilizers was presented at the Fertilizer Industry Round Table, November 5-7, 1958, Washington, D. C. The comments below were made by Joseph E. Reynolds, Jr., of the Davison Chemical Co., Baltimore, Md.

Observations on effects of urea on nitrogen solutions were also presented at the Round Table, and appear on page 50, following our report of Mr. Reynolds' comments.

THE basic economics of formulating mixed fertilizers with nitrogen solutions in combination with anhydrous ammonia promotes the use of that nitrogen solution which contains the highest fixed-to-free nitrogen ratio. The nitrogen solution with the highest fixed-to-free nitrogen ratio also reflects the lowest amount of free ammonia which must be neutralized per pound of solution used. The ability to use this combination of liquid nitrogen materials affords the maximum usage of the most economical source of nitrogen.

Approximately 3 years ago, the ammonia-ammonium nitrate solutions which most closely conformed to these qualifications were either an 83% ammonium nitrate solution with no anhydrous ammonia and a salting out temperature of 154°F; or a 32% nitrogen solution, often referred to as "R" with a fixed-to-free nitrogen ratio of 3.83 and a salting out temperature of 93°F; or a 37% nitrogen solution with a fixed-to-free nitrogen ratio of 1.70 and a salting out temperature of 48°F. The 37% nitrogen solution was selected for our use primarily for its most practical salting out temperature, under operating conditions, and its application to the production of a competitively priced, high quality, 15-15-15 at a reasonable production rate.

High Fixed-to-Free Nitrogen Ratio Solutions

	R	37	Dehydrated 37	3XD	11
Total Nitrogen	31.8	37.0	41.4	41.4	41.0
Composition by Weight					
Free Ammonia %	8.0	16.6	19.0	19.0	19.0
Ammonium Nitrate %	72.0	66.8	74.0	65.6	58.0
Urea %	—	—	—	6.0	11.0
Water %	20.0	16.6	7.0	9.4	12.0
Vapor Pressure, Psig @ 104°F	1	1	8	13	10
Salting Out Temperature °F	+93	+48	+64	+35	+ 7
Ratio Fixed N/Free N	3.83	1.70	1.65	1.65	1.63

The use of the 37% nitrogen solution, with an increased liquid phase due to the use of larger amounts of ammonium nitrate in the Davison-Trenton pug mill process, was accomplished with minor adjustments in operating techniques. The operational, quality, and analytical demands of the resulting product conformed to established standards for grades containing less ammonium nitrate. Shortly after adoption of the 37% solution, the total nitrogen content of most nitrogen solutions was increased through creation of a line of dehydrated or lower moisture containing solutions. The fertilizer industry profited through lower delivered nitrogen costs, but the properties of the established solutions were changed. In the case of the now dehydrated 37% solution, a 41.4% nitrogen solution resulted with a 64°F salting out temperature.

The grade pattern and tons of 1-1-1 ratio grades at several of our plants justified the cost for heat exchangers, recirculation lines to and from the storage tank, and heat traced lines to permit the use of this higher temperature salting out solution during the coldest weather. In the case of our smaller tonnage plants where no heated storage and handling equipment existed, for these high salting out

solutions, the high fixed-to-free nitrogen ratio solutions still offered economic advantages. While reviewing the standard nitrogen solutions available, it was noted that an ammonia-ammonium nitrate solution containing 11% urea was almost a duplicate of the dehydrated 37 with 41.4% total nitrogen and a fixed-to-free nitrogen ratio of 1.63-1.65. One big difference existed, the number 11 solution was characterized by a salting out temperature of only 7°F rather than 64°F for the dehydrated 37. The possibility of using a high fixed-to-free nitrogen ratio with a 57°F lower salting out temperature warranted an immediate investigation into the use of urea-ammonium nitrate solutions.

Only limited information was available on the quality limitations of urea in pulverized mixed fertilizer, but these limits had been established as 50 lbs. of urea per ton of fertilizer. Although even less information was available to establish the limits of urea in granulated mixed fertilizers, the 50 lbs. of urea per ton was arbitrarily chosen at the time. Since then, this limit has proven to be fairly reliable as a rule of thumb. The use of number 11 solution in high 1-1-1 ratio grades reflects a larger percentage ratio of urea to ammonium nitrate than recommended. Later plant production tests of 12-12-12 with number 11 solution in a plant that had been using a +26°F salting out temperature nitrogen solution with a fixed-to-free nitrogen ratio of 1.25, confirmed that although that granulation was comparable with this solution, the granules did not possess the same hard gritty "feel" associated with the nitrogen solution without urea. Furthermore, the granules later broke down in the pile.

The knowledge of some of the properties of number 11 solution in granulated mixed fertilizers caused interest in changing the specifications of the dehydrated 37 solution through the addition of urea. Although heated storage was provided at our larger granulation installations for a nitrogen solution which salted out at 64°F, some ammonium nitrate crystals did form during prolonged periods of cold weather. These crystals plugged semi-idle lines, caused damage to the flowmeter, pumps, and heat exchanger. It was primarily for the reason of maintenance and convenience that we searched for a solution with a lower salting out temperature. Also, why use a nitrogen solution which required the cost of constant heating when a nitrogen solution is available to provide the same formula savings but requires much less heating and maintenance expense.

Since a zero urea, 64°F salting out solution with a 1.65 fixed-to-free nitrogen ratio was satisfactory in the production of granulated mixed fertilizers, and a 11% urea, 7°F salting out solution with the same fixed-to-free nitrogen ratio would most probably be unsatisfactory due to the large quantity of urea, we naturally became interested in a solution with a urea content someplace between 0 and 11%

Thus, the 6% urea solution came into being and was initially known as 3XD. 3XD solution contains 41.4% total nitrogen, 19.0% free ammonia, 65.6% ammonia nitrate, 6% urea, and 9.4% water. This solution was also designed to maintain a urea content in high analysis grades below 50 lbs. of urea per ton of product.

Plant investigations with 3XD solution revealed the following:

1. The use of 3XD solution was operationally interchangeable with the ammonia-ammonium nitrate solutions in the Davison-Trenton process.
2. The particles were slightly more rounded due to the presence of urea, but just as hard.
3. The quality of the granules in bulk and bag storage was equal to, or slightly better than, comparable grades formulated from ammonia-ammonium nitrate solutions.

The above accomplishments were possible with a solution containing urea, ammonia and ammonium nitrate, and still provided the same economical advantages as the original 37% nitrogen solution. These advantages were *now* possible with a solution which salted out at a temperature of 35°F, rather than 64°F.

The user of a urea-ammonium nitrate solution will first notice the "early" softness of the particles coming from the ammoniator granulator. The operator soon recognizes the importance of adjusting water control techniques and must recognize the difference between water wetness and an increased liquid phase. These features are very closely related, and are often simply described as being related to the time required for the particles to take up the water and cure out. The crystal growth in particles containing urea is slower than that experienced for grades formulated with an ammonium nitrate solution. Caution in drying must be exercised so that the moisture is not driven off before the particle set has occurred. The increased liquid phase from the 3XD solution can result in the formation of larger particles from the granulator, unless adjustments in recycle or wetness are made. A low moisture content in the product is equally important for any grade containing large amounts of either 3XD or 37% solution.

Recently, two urea-ammonia-ammonium nitrate solutions, which salt out at 10° and −17°F, but with a fixed-to-free nitrogen ratio of 1.40 and 1.43 respectively, have been introduced to our industry. These 6 and 7% urea-containing solutions will compete with the ammonia-ammonium nitrate solution at plants that do not have heated storage and have been using solutions of a lower fixed-to-free nitrogen ratio, such as .90-1.25 Our plant experience with these urea-containing solutions in comparison with a 44% nitrogen ammonium nitrate solution containing 23.8% ammonia, which salts out at +26°F, indicates an early adoption of these new 1.40-1.43 fixed-to-free nitrogen solutions.

The quality of the new product appears to be excellent, the production rate is the same, and definite formula savings exist when comparing the use of these new 6 and 7% urea solutions with more widely used ammonia-ammonium nitrate solutions of lower fixed-to-free nitrogen ratios.

The use of urea originally as a temperature depressant in ammonia-ammonium nitrate solutions has opened many avenues for more economical formulation. Fertilizer manufacturers were naturally hesitant to use large amounts of solutions containing urea and ammon-

NOW

Espesol 5 Registered For Labeling Purposes As A XYLENE-BASE SOLVENT

Formulator-proven as an economical, non-phytotoxic diluent with dependable uniformity!

Now registered as a xylene-base solvent, Espesol 5 meets all the demands of formulators who require an economical water-white, xylene-base diluent possessing absolute uniformity. Being a direct unit-produced, rather than a blended product, Espesol 5 provides you with (1) a constant weight (pounds per gallon) (2) uniform flash point (3) consistent aromatic content. With its narrow boiling range, Espesol 5 offers a fast evaporation rate and its high percentage of aromatics provides high solvency power.

Approved by government and college experiment and extension facilities, Espesol 5 is a premium quality, high specification diluent that will let you offer your customers a premium product. Available to you on short notice from all of Eastern States' terminal facilities, Espesol 5 can be ordered in drum, transport, tank car, barge and ship tank lots.

Mail coupon below for complete information.

EASTERN STATES PETROLEUM & CHEMICAL *Corporation*

(Formerly Eastern States Chemical Corporation)

P. O. Box 5008 • Houston 12, Texas • Phone WAlnut 3-1651

Chicago Office: Phone Village 8-5410
New York Office: Phone Circle 7-2520
Cleveland Office: Phone Edison 3-0188
Louisville Office: Phone Juniper 3-7634
Atlanta Office: Phone Cedar 3-3227
Los Angeles Office: Phone Ryan 1-0278

ESPECO

Eastern States Petroleum & Chemical Corporation
P. O. Box 5008, Dept. AC 4-9, Houston 12, Texas

Please send me free booklet on the characteristics and properties of insecticide solvents.

NAME_____

FIRM_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

U.S. TERMINALS: Houston, Tex. • Chicago, Ill. • East Liverpool, O. • Madison, Ind. • Brownsville, Tex. • Savannah, Ga. • Carteret, N.J. • Los Angeles, Calif
EUROPEAN TERMINALS: Dordrecht (Rotterdam), Netherlands • Antwerp, Belgium • Ludwigshafen, Germany • Livorno (Leghorn), Italy

ium nitrate, for fear of urea breakdown when the particles were subjected to drying and an increased hygroscopicity of the product. A place for urea-ammonia-ammonium nitrate solutions has been established in the production of granulated mixed fertilizers, with many advantages possible to the company that recognizes its properties and its limitations.★★

H. H. Tucker

Re: Effects of Urea on Ammonium Nitrate-Ammonia-Water Solutions

By H. H. Tucker
Sohio Chemical Co.
Lima, Ohio

THERE is considerable published information on saturation temperatures and vapor pressures of ammonium nitrate-ammonia-water solutions and on urea-ammonia-water solutions. Little information of this type has been published on four-component solutions containing ammonium nitrate-urea-ammonia-water.

Urea is added to ammonium-nitrate-ammonia-water solutions for the effect it has on the physical properties of the solution and for its effect on the manufacturing and conditioning of the end product.

Effect of urea on Physical Properties of Nitrogen Solutions

The addition of urea to ammonium-nitrate and ammonia in nitrogen solutions has been shown to reduce the saturation or salting out temperature of the solution. This makes possible the use of higher ratios of salts to ammonia or the increase to what is termed the fixed to free nitrogen ratio. Reducing the saturation temperature may, therefore, permit a reduction in the amount of water.

The increase in the fixed to free nitrogen ratio or the reduction of ammonia reduces the vapor pressure of the solution. The reduction of ammonia reduces the nitrogen content of the solution since an 82% nitrogen material is being replaced by salts which contain 35 or 46% nitrogen. Interaction of all of these factors must be considered in the formulation of nitrogen solutions.

Effect of Urea on the Manufacture of Fertilizers

Work has shown that the addition of urea to fertilizer mixes containing ammonium-nitrate and potassium chloride will increase the plasticity of the material and improve granulation. This increased plasticity is due to the increased solubilities of combinations of urea and ammonium nitrate or ammonium chloride. To prevent excessive plasticity, the amount of urea which can be added to ammonium nitrate containing fertilizers is limited. At 86°F. 100 grams of water will dissolve 242 grams of ammonium nitrate or 133 grams of urea. At the eutectic point of 46 parts urea to 54 parts ammonium nitrate, 100 grams of water will dissolve 1564 grams of combined salts at 86°F. The 242 grams of ammonium nitrate in 100 grams of water will increase the solution volume from 100 to 251. 133 grams of urea in 100 grams of water will increase the solution volume from 100 to 201. The 1564 grams of combined urea-ammonium nitrate at the 46-54 ratio will increase the solution volume from 100 to 1206. This would mean that these salts could be proportioned to increase the volume of one pint of water from 2 to over 12 pints of solution even at 86°F. At higher temperatures the solubilities would be even greater.

The solubility of combinations of urea or ammonium nitrate in water increases gradually with first additions of the second salt. This solubility increases very rapidly as the eutectic combination is approached. For these reasons dry fertilizers containing urea and ammonium nitrate near eutectic proportions may become soggy or plastic at relatively low moisture contents and particularly so at high temperatures.

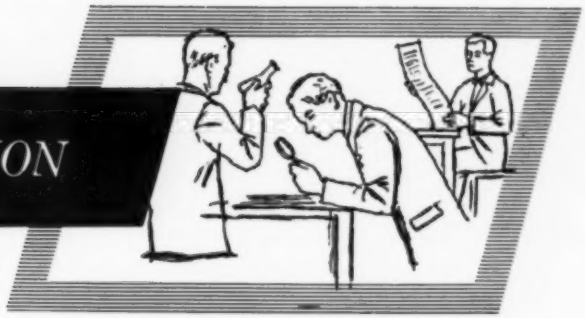
Properly formulated, the combination of urea and ammonium nitrate can be beneficial in contributing to plasticity at high temperatures for desired granulation and give good hard granules when the excess heat is removed. A low ratio of urea to ammonium nitrate, however, is necessary in order to prevent sogginess or tackiness of the dry end product.

Effect of Urea on the Conditioning of Fertilizers

Work has shown that the addition of urea to fertilizer mixes containing ammonium nitrate and potassium chloride will change the crystal structure of the resultant ammonium chloride from a fern-shaped or dendritic crystal to a cube crystal. This change in shape of crystal formation has definitely been shown to reduce caking or setting of resultant fertilizers. Hygroscopic properties as well as solu-

(*Continued on Page* 124)

TECHNICAL SECTION



Organophosphate Ovicides

Report prepared by E. H. Smith and A. C. Wagenknecht
New York State Agricultural Experiment Station, Geneva, N. Y.

ALTHOUGH extensive investigations have been conducted on the toxic action of organophosphates to mammals and hatched insect forms, relatively little has been done on ovicidal action. This report covers investigations on how organophosphates kill insect eggs.

This group of insecticides includes such well known materials as parathion, malathion, TEPP, demeton and numerous others currently being introduced. The organophosphates are known as nerve poisons, because of their action in inhibiting an enzyme vital to nerve transmission. In insects as well as mammals, transmission of impulses is accomplished by the same general process. The three components of the system are:

1. Fully developed nerve fibers or neurons which are characterized by synaptic junctures; that is, the network of nerve connections is not continuous, gaps occurring across which nerve impulses are conducted.
2. Acetyl choline (ACh) the conductor which regulates the flow of impulses across synaptic junctures or from nerve to muscle.
3. Cholinesterase (ChE), the enzyme which removes the spent ACh.

Oddly enough, ACh, a normal component of the nervous system, is itself highly toxic if allowed to accumulate. Thus when ChE, the safety device for removing Ach, is inhibited, ACh accumulates and death ensues. While this generalized version explains the mode of action in mammals and probably hatched insects, it was not readily reconciled with ovicidal action. The chief obstacle was that eggs were susceptible in early stages of development before the nervous system was differentiated and presumably before ChE was present. It was this anomaly which led to the investigation reported here.

Field Studies

INITIAL leads for the biochemical phases of this work were gained from field control studies. A single parathion spray applied for peach tree borer control gave results under local conditions equal to that obtained with three DDT sprays. This control was due chiefly to the kill of eggs.

Such spectacular results seemed inconsistent with two seemingly obvious points. First, parathion was believed to remain effective for only a few days after application; and second, less than half of the eggs were present when treatment was made.

Residue studies showed that porous bark took up three times as much residue as the leaves and retained it much longer. The eggs deposited on the tree trunks were thus exposed to parathion in two ways: those present at time of treatment were covered directly, while those deposited later were enveloped in vapor arising from the residues.

As would be expected, all eggs sprayed directly were killed. In addition, the residues remained effective in killing eggs for several weeks after treatment. By withholding treatment until just before the earliest eggs hatched, the effectiveness of the spray spanned virtually the entire period of egg laying.

In trying to account for the extended killing action of para-

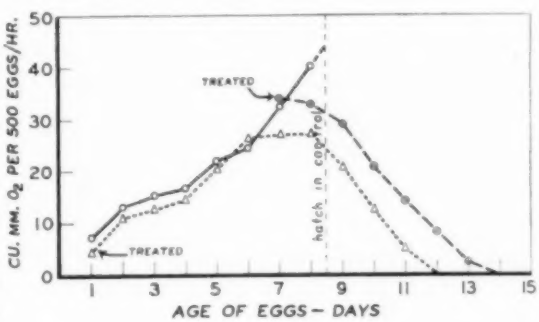
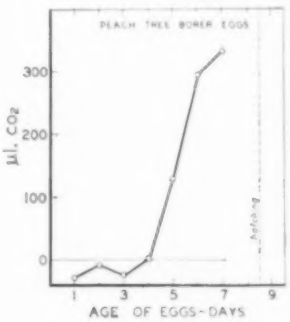


Fig. 1. (left) Respiratory rate of peach tree borer eggs. The solid line represents untreated eggs, while the broken line represents eggs treated with parathion. (1).

Fig. 2. (right) The occurrence of cholinesterase in developing eggs of the peach tree borer. (2).



thion as observed in the field, a simple test was conducted in the laboratory. Eggs deposited on paper were suspended in a jar, the walls of which had been treated with parathion. This exposure involving no direct contact between residue and egg proved fatal. Such action indicated that the poison entered the egg as vapor, probably during respiration. (1)

Respiratory Studies

As symptoms of toxicity to hatched forms—such as hyperactivity, convulsion and paralysis—do not apply to eggs, it was not evident when the lethal effect took place. Respiratory studies were undertaken assuming that any treatment drastic enough to cause death must interfere with some vital process, and this interference would be reflected in respiratory rate. The rates of treated and untreated eggs are shown in Figure 1. These results throw little light on when lethal effects occur. Treatment early or late resulted in no marked change in respiratory rate until just before hatching, when the rate gradually declined, and death occurred several days after the normal time of hatching. Here was a curious delayed action effect, whereby treatment of newly laid eggs showed no effect until near hatching. With respect to systems involved, this posed two possibilities:

1. A system is attacked at the time of treatment, but this system is not vital until late stages of development.
2. The vital system under attack is not present until late stages of development.

The latter possibility presupposes the retention of the toxicant until development of the vital system. The second possibility had further to be reconciled with the point previously made that eggs were most susceptible in early stages of development.

Enzyme Studies

In considering the mode of action of ovicides, attention was naturally focused on ChE, although it might be assumed that this enzyme might not be present in the undifferentiated egg,—and if present, was not vital at this time. The results of enzyme determinations in eggs of various ages are shown in Figure 2. ChE first appeared about the middle point of incubation and increased thereafter until hatching. Enzyme determinations on treated eggs showed that treatments at any time finally resulted in inhibition of the enzyme. This was conclusive evidence that in the treatment of newly laid eggs, parathion could not immediately attack this enzyme, and that later attack could occur only if parathion or its metabolites were retained in the egg.

While inhibition of ChE had been demonstrated, it was still not known what effect this had on ACh levels. This question was investigated by Canadian workers using eggs of the housefly (3). They determined the occurrence of both ACh and ChE in treated and untreated eggs. Their findings with respect to occurrence and inhibition of ChE were in general agreement with results using peach tree borer eggs. ACh first appeared at nine hours (12 hours incubation period) and increased rapidly thereafter. In treated eggs, where ChE was completely inhibited, ACh levels were 50% above normal. It appears then that just as in the mammal studies, ChE inhibition in eggs leads to excessive levels of ACh, which in turn accounts for toxic effects.

The possibility should not be overlooked that ovicidal action might be due to the inhibition of some other enzyme which plays a vital but as yet unknown role. Until more is known of other enzymes and their roles, the weight of evidence points to ChE inhibition as the mode of ovicidal action.

Piecing together the various bits of evidence cited, the ovicidal action of parathion may be explained as follows: Parathion vapor gains entry to the egg probably in the exchange of gases in the respiratory process. After gaining entry, the parathion is retained, later acting on ChE. This inhibition is of no physiological importance in the absence of ACh. Initially, ACh is present at low levels, but as nervous activity continues and without the normal controlling mechanism, ACh accumulates to toxic levels and death ensues.★★

Literature Cited

1. Smith, E. H. 1955. Further studies on the ovicidal action of parathion to eggs of the peach tree borer. *Jour. Econ. Ent.* 48(6) 727-31.
2. Smith, E. H. and A. C. Wagenknecht. 1956. The occurrences of cholinesterase in eggs of the peach tree borer and large milkweed bug and its relation to the ovicidal action of parathion. *Jour. Econ. Ent.* 49(6) 777-783.
3. Mehrotra, K. N. and B. N. Smallman. 1957. Ovicidal action of organophophorous insecticides. *Nature* 180: 97-98.

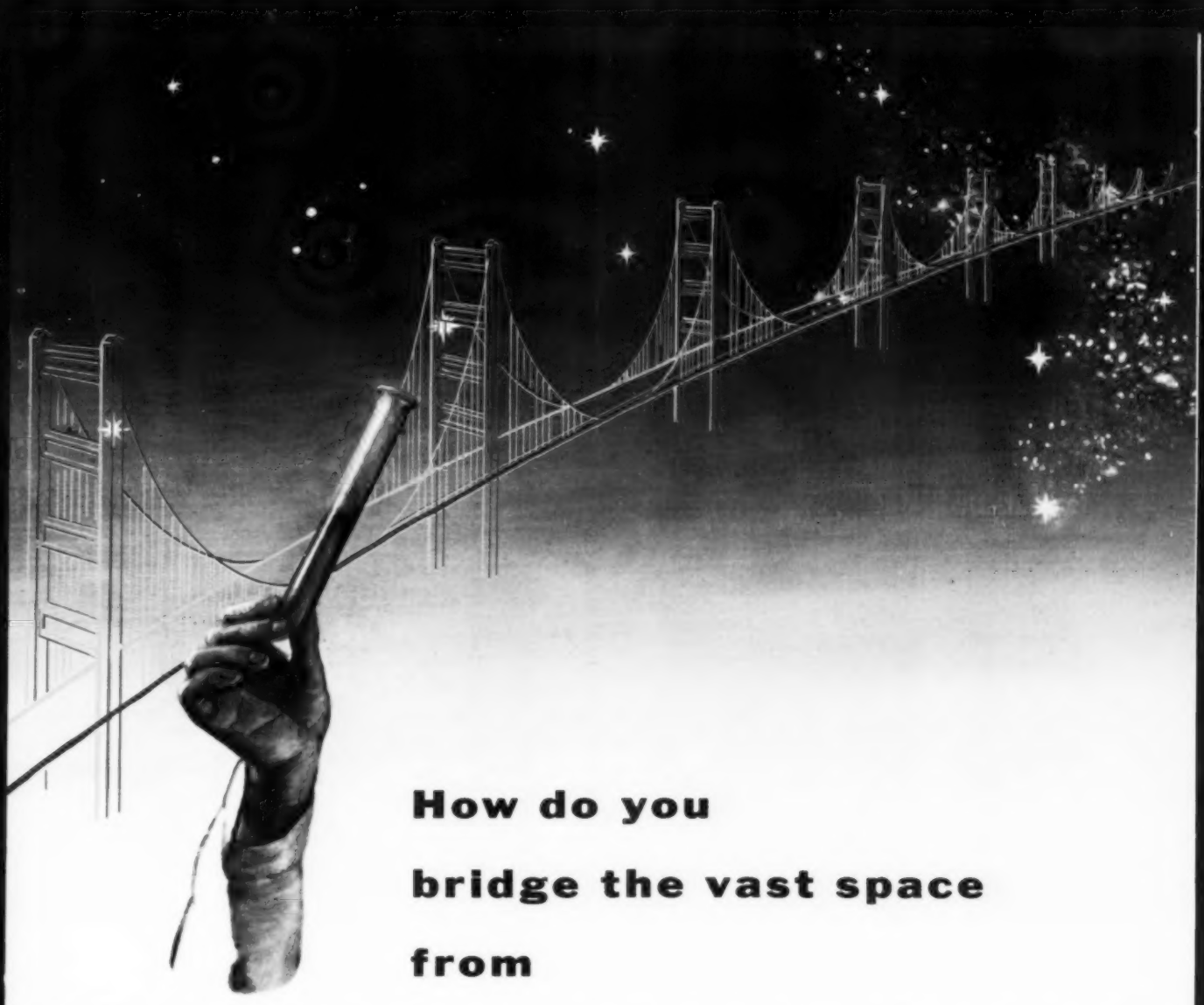
•

Du Pont Offers Liquid Arasan

The first commercial liquid uniform flow of the treated seed suspension of thiram, for slurry treatment of seed and for use as a paint or spray repellent against rodents, rabbits, deer and birds, has been developed by the Du Pont Company, Wilmington. Called "Arasan" 42-S seed disinfectant and protectant, the new product is a stable suspension of fine particles of thiram, containing four pounds of active material per gallon of product. It can be used wherever slurry treatment of seed with "Arasan" is recommended. The liquid formulation is easy to measure, and disperses almost instantaneously when it is added to water. The fine particles of chemical adhere tightly and uniformly to the seed without dusting off, giving through planting equipment.

"Arasan" 42-S will be sold through distributors handling Du Pont seed disinfectants, and will be packed in one-and five-gallon drums.

For slurry treatment it is used through, even coverage for maximum fungicidal protection and at rates ranging from two and three-quarters pints to 11 pints per gallon of water.



How do you bridge the vast space from RESEARCH to REALIZATION?

It seemed a preposterous idea.

When Dr. Karl Paul Link and his associates at the University of Wisconsin originally proposed that an anticoagulant chemical be used to destroy rats and mice, it seemed a preposterous idea . . . unprecedented and audacious.

But to the Wisconsin Alumni Research Foundation it was a challenging, intriguing idea as well. In cooperation with the inventors, the Foundation guided the development phases of the discovery, and even gave it a name . . . WARFARIN

They accumulated field data from every continent on earth, weighed the benefits and hazards, perfected manufacturing processes, pursued patents, administered commercial licensing, launched a public education program, nurtured the rapid growth of the new-born industry.

Within 5 years the chemical had become the world's foremost weapon against commensal rodents . . . and its name, WARFARIN, had become a part of every language. Today it forms the basis for a $20,000,000.00 a year business.

This is one example of the manner in which the Wisconsin Alumni Research Foundation fills the imposing gap between research and realization.

WISCONSIN ALUMNI RESEARCH FOUNDATION

MADISON 1, WISCONSIN

WISCONSIN ALUMNI RESEARCH FOUNDATION

QUIZ

For Multiwall Bag Buyers

"How Does Your Packaging Operation Rate?"

Perhaps we may be able to help you to arrive at the right answers in order to achieve higher production at lower costs.

KRAFT BAG CORPORATION

Gilman Paper Company Subsidiary

630 Fifth Avenue, New York 20, N. Y.
Daily News Bldg., Chicago 6, Ill.

Plants at St. Marys, Ga. and Gilman, Vt.

Sales Agents for The **Kraftpacker** Open Mouth Bag Filling Machine

Gilman PAPER CO.
• St. Marys Kraft Corp.
• Gummed Tape Div.
• The Gilmanized Corp.
• Kraft Bag Corp.

☐ O.K. Kraft... Help me to answer your Quiz. Please have representative call. AC

COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE____

PRODUCT MFD_____

NAME_____

Control of Mosquitoes

Climate and soil conditions at Brays Island, near Yemassee, S. C., make the island an ideal site for raising livestock. Unfortunately, these conditions also favor the buildup of insect pests.

Mosquitoes have always been a problem, particularly the salt marsh species. Controlling them on an island-wide basis has been practiced for about eight years, and until this past year various chlorinated hydrocarbon insecticides provided good control. Early this season signs of resistance to these materials began to appear, and new answers were needed.

Frank Arnold Jr., medical entomologist for the South Carolina State Board of Health and Dr. Wm. Goodwin of Clemson College's Department of Entomology tried blanket applications of malathion. Results surpassed even the highest degree of effectiveness anticipated. Mosquito counts were averaging better than 27 mosquitos per check station. Within 24 hours after the first spray they had dropped to 0.015 mosquitoes per station. The residual effectiveness lasted almost 24 days.

"Island Experiment: Control of Mosquitoes," Cyanagrams, Vol. 5, Nov. 3, Fall, 1956. American Cyanamid Co., New York.

•

Dalapon for Grass Control

Successful use of sodium dalapon as a grass killer in Hawaiian sugar cane fields is described in the fall edition (1958) of *Down to Earth*, published by the Dow Chemical Co., Midland, Mich. "Early tests with dalapon on Bermuda grass, torpedo grass, and para grass showed this chemical to be from four to eight times as effective for controlling these species as was TCA."

"For species like the foxtails and crab grasses, dalapon had about twice to three times the effectiveness of TCA. Consequently, for the control of the rhizomatous grasses, present recommendations are set at from five to ten pounds active dalapon, in the form of the sodium salt, per acre per application. Usually two or three applications are needed to complete eradication. The recommended mix for non-rhizomatous grasses is 0.1 to 0.2 lbs. sodium dalapon per gallon.

The article observes that dalapon in combination with 2,4-D has proved practical as a pre-emergence and grass-killer mix, but that it should not be sprayed on either the leaves or stalks of the sugar cane. Other precautions urged are the application of sodium dalapon so as to avoid in excess of five pounds acid equivalent per acre in any one spraying operation within the field, and the avoidance of application of more than ten pounds per acre in any one crop.

•

Fungus Nematode Control

Experiments in England to control nematodes by building up concentrations of fungus in the soil were recently reported by the British Information Service to have shown promising results. Researchers have discovered that certain predaceous types of fungus also present in the soil can actually trap, kill, and then digest the nematodes. Much of the work was done at Regent Street Polytechnic, London.

The fungi trap the nematodes in a number of ways. Short, sticky branches of the fabric of the fungi may join up to form a sort of meshwork which snares wandering nematodes. In other cases nematodes are caught in a ring formed by fungus structure, and are then killed and digested.

In field experiments in Lincolnshire one potato ridge in a field affected by nematodes was treated with ordinary farmyard manure, another with fungi added to manure. The untreated row produced 21 pounds of potatoes, the row treated with farmyard manure produced 41 pounds, and the one treated with manure and fungus, 78 pounds. Similarly promising results are also reported with pea and cereal crops.

•

Cattle Parasite Control

Parasite infection may be controlled effectively by the continual low-level feeding of phenothiazine. Long used as an anthelmintic, this drug has shown encouraging results at the Ohio Agricultural Experiment Station, Wooster, for control of roundworms in horses, and a number of parasites in cattle and sheep.

Tests were conducted on 22 purebred Texas Hereford heifers, revealed, by microscopic inspection, to be moderately parasitized. In the test group, phenothiazine was combined with ground corn and cob meal at the rate of one gram of the drug to one pound of corn and cob.

When phenothiazine was administered to heifers naturally infected with internal parasites, the parasite eggs per gram of manure dropped from an average of 34 before treatment to 4 for the treated group. It was revealed also that continuous low-level feeding with the drug will kill grub larvae if treatment is given during the migratory phase. "Phenothiazine Offers Control of Cattle Parasites," by N. B. King, H. R. Smith, F. R. Koutz, and E. W. Klosterman, in *Ohio Farm and Home Research*, Sept.-Oct. 1956.

•

Cyanamid & Super for Tobacco

Yields of approximately 30,000 tobacco plants per standard bed have been reported by the University of Kentucky Agricultural Experiment Station through soil treatment with new combinations of calcium cyanamide and superphosphate.

The use of calcium cyanamide to kill weeds in tobacco beds is a standard practice. However, in heavy soils, decomposition of the cyanamid may leave a high concentration of ammonia which, if allowed to persist, can damage tobacco plants. This problem has been most prevalent on some of the heavy soil types in Kentucky, where superphosphate has been successfully used to nullify the residual toxic effects.

Previous Kentucky recommendations have called for 1½ pounds of calcium cyanamide and ¾ of a pound superphosphate per square yard of tobacco bed. According to Russell Hunt, extension burley specialist, and Dr. William Seay, soils specialist, experimentation indicates that application of two pounds of superphosphate per square yard of soil will increase the yield of plants from two pullings by as much as one third over previous-

ly considered satisfactory yields of 20,000 plants.

Mr. Hunt said that test tobacco beds in eight central Kentucky counties have been treated this fall at the rate of two pounds of superphosphate and 1½ pounds of calcium cyanamide per square yard of bed.

In experimentation plots, yields have ranged from 2,250 plants with no superphosphate or calcium cyanamide, through 15,500 plants with 1½ pounds of calcium cyanamide and one pound of superphosphate, to 29,700 plants when the superphosphate was increased to two pounds.

According to Kentucky findings, 18% to 20% superphosphate is the only phosphate material which is effective. Triple superphosphate and calcium metaphosphate, used at rates to supply equal phosphorus, failed to correct the ammonia toxicity.

•

Fertilizer-Dieldrin Mix

Although the University of Kentucky's Agricultural Experiment Station does not now recommend the use of fertilizer-insecticide mixtures for tobacco plant beds, it has found it advisable to register such materials under the Kentucky Fertilizer Law and the Kentucky Economic Poisons Law. This action eliminates the necessity of custom mix operations for these mixtures and will provide more ease in distribution.

The station has felt that the use of fertilizers in conjunction with insecticides for plant beds would result in the waste of some fertilizer materials due to leaching or inadequate insecticidal activity due to improperly timed application. For the present, dieldrin will be the only insecticide authorized for use in fertilizer-insecticide mixtures for tobacco beds against grub worms.

•

Test Sevin On Goldfish

The Union Carbide Chemicals Co., a division of the Union Carbide Corp., New York, reports that recent tests conducted by the Boyce Thompson Institute indicate that Sevin insecticide is 200 times less toxic to goldfish than DDT.

NEW BOOKS

Concentrated Spray Equipment

An exceedingly valuable, authoritative and lucid book has just been published (Dorland Books, Caldwell, N. J.) under the above title. This work, by Samuel Frederick Potts, is the result of many years of study and experience by the author who early sensed the need for the replacement of ponderous, costly and often inadequate procedures in the treatment of forest pests.

This volume should be in the hands of every leader of large scale control projects and every individual or organization that has anything to do with the manufacture, distribution or use of equipment and materials for the control of pests of forests and field crops. It should be especially helpful to those who do contract or service spraying. The appendix is particularly useful in this connection. The tables, drawings and photographs, together with the extensive bibliographic references make the book a manual of importance and utility.

Ernest N. Cory

Specifications and Methods of Analysis for Certain Pesticides, compiled by the Ministry of Agriculture, Fisheries and Food, London, England.

The first two editions of this bulletin (issued in 1949 and 1951) brought together under one cover all the specifications and methods of analysis which had then been drawn up. In the present edition the text has been rearranged into three different parts dealing with specifications, methods of analysis and a miscellaneous section.

Insects and Mites of Western North America by E. O. Essig. Published by the Macmillan Co., New York. 1050 pages, price $18.

A revised edition of "Insects of Western North America," which first appeared in 1926 and was revised in 1954, this book is an attempt to give specific information, both economic and technical, rather than to produce a critical treatise on classification and nomenclature. Included are first-hand knowledge and experience of the author—who is Professor of Entomology, Emeritus at the University of California—as well as material gleaned from western entomological libraries. It should be a handy manual for entomologists and agriculturists as well as for foresters, farmers, and gardeners.

Tree Fruit Production by James S. Shoemaker and Benjamin J. E. Teskey. Publisher: John Wiley & Sons Inc., New York, 1959. 456 pages. $6.95. *Reviewed by Vincent Sauchelli.*

The authors are well-known authorities among horticulturists and have jointly authored another text book, "Practical Horticulture" also from the same publishing house. The book under review represents a compilation of the latest information on the production of apples, pears, peaches, cherries, plums, citrus fruits and apricots, nectarines and quinces. More than 800 references to recent horticultural information on fruit culture are given. Not only are practices strictly related to fruit tree culture treated, such as pruning, thinning, harvesting, storage and marketing, but much practical information is given on soil management and fertilizer practices.

This book should be indispensable to practical orchardists, farm advisers and vocational agricultural teachers. Dr. Shoemaker is nationally known as an authority in the field of horticulture and has had wide experience as teacher and research worker. Mr. Teskey is an experienced teacher of horticulture. Their combined talents, as reflected in this new text book, have succeeded in producing a work of exceptional merit.

•

Other Literature

FERTILIZING CONNECTICUT TOBACCO, by Henry C. de Roo. New fertilization methods were made necessary by the introduction of synthetic binders for cigars and the resulting disappearance of the premium price for perfect leaf binders. This 37-page bulletin is a complete report of more economical fertilizer practices. Bulletin 613, March 1958. Connecticut Agricultural Experiment Station, New Haven.

CHEMICAL WEED CONTROL FOR THE ATLANTIC PROVINCES, by J. S. Leefe. A guide to the use of chemical herbicides based on experience at experimental farms in the Atlantic Provinces of Canada. In general, directions given in the bulletin are for particular crops. Experimental Farms Service, Canada Department of Agriculture, Ottawa.

PIPER

The World's Leading Builder of Agricultural Aircraft

The Piper PA-18-A, world's most widely purchased agricultural airplane, is equipped at the factory with spray and dust equipment engineered for effective and economical dispersal of chemicals.

Experienced operators the world over choose the PA-18-A for the efficient performance, unmatched reliability and low costs that add up to profitable operations.

The PA-18-A combines terrific load-carrying capacity with the ability to land and take off safely in minimum space, close to each individual job. Solid or liquid chemicals are conveniently loaded in shortest possible time, and dispersed in precise, rigidly controlled patterns.

Powered by a dependable 150 horsepower Lycoming engine, the PA-18-A is available either as a sprayer (with 110-gallon tank capacity), duster (with hopper capacity of 18 cubic feet) or as a combination unit, quickly interchangeable.

Study the facts, features and figures—and see for yourself why PA-18-A performance is unsurpassed, especially where fields are short and there's a premium on precision.

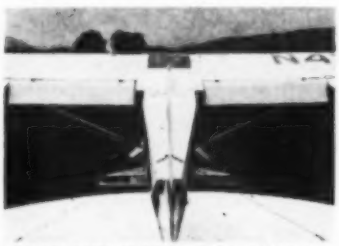
SEND FOR DETAILS.
New brochure on 1959 PA-18-A now available. Write Dept. M-2

PIPER
AIRCRAFT CORPORATION
Lock Haven, Pennsylvania

"FLOATING" SPRAY BOOMS are hinged to swing back if they come in contact with ground objects. Nozzles, rigged for application at rates from one-half to 15 gallons per acre, are self-closing. Positive action of cockpit lever assures complete shut-off of spray with no drip.

SPRAYER PUMP is heavy duty centrifugal type. Pressure system incorporates by-pass lines to agitate liquid chemicals for uniform mixture. Load can be dumped in seven seconds in emergency.

PA-18-A DUSTER has gross weight of 2,070 pounds, payload of 1,010 pounds with standard equipment. Hopper capacity is 18 cubic feet. Wind-driven double agitator assures uniform flow of dust into venturi dispersal unit. Dust is dispersed in effective maximum swath of 70 feet, working swath of 50 feet.



HIGH-LIFT FLAPS permit PA-18-A, fully loaded, to take off in 100 yards, reduce landing roll to less than 140 yards. With flaps extended, PA-18-A lands at 45 miles an hour. Partial flap enhances down-wash in dusting operations.

LOADING IS EASY and uncomplicated through hatch on flat top deck with metal reinforcement. Large air scoop keeps solid chemicals from caking. Convenient baggage compartment has separate door on right side of fuselage.

SIX-FOOT VENTURI, fed through double throat, lays 70-foot swath—50-foot working swath—with excellent downward penetration. Aerodynamically correct openings are designed to counteract spiral slip stream..

MORE PEOPLE HAVE BOUGHT PIPERS THAN ANY OTHER PLANE IN THE WORLD

The AGRICULTURAL Applicator

- Spraying Bananas
- Prescription Pest Control
- Louisiana Conference
- Texas Aerial Meeting
- Mississippi Meeting

Prescription Pest Control

TWO decades ago, agricultural applicators were forced to limit themselves to three basic pesticides, Black Leaf 40, arsenate of lead, and Paris green. Today, however, with the wide variety of chemical pesticides available, pest control is getting to be a prescription business, in the opinion of W. E. Greene, operator of Oregon Agricultural Chemicals in Tulelake, California.

Mr. Greene feels that effective weed, insect, and fungus control at minimum expense is a lot more complicated than just following the simple instructions on the can. His company's operations, for instance, are carried on by two separate sections, one industrial and the other agricultural.

Besides application work on crop lands, the agricultural section does much to instruct the farmers, themselves, on the use of equipment and pesticides. The section works closely with such organizations as the 4-H Clubs to make sure that the young people are acquainted with chemical pest control. The company sponsors demonstrations that utilize scale models and colored transparencies of insects, nematodes, weeds, and other pests.

On the industrial side, OAC has worked with responsible officials in developing such programs as reforestation, road maintenance, mill maintenance, and water movement clearance. The industrial section's application service is headed by Earl Siberts, an operator with ten years of experience. OAC's industrial operations cover a five-state area of Arizona, Washington, Oregon, California, and Alaska. The firm's service men, who spend most of their time in the field, either are graduate agronomists or have complete, practical backgrounds in pest control. The field men evaluate programs for industrial or public lands and project these programs to estimate costs and application rates for future seasons.

For each pest problem the company surveys, a comprehensive report is submitted to responsible officials that outlines the problem, the work to be done, the chemicals needed, and the cost. An example of this is a proposal submitted to the White Pass and Yukon Railroad to control weeds along 90 miles of track emanating from Skagway, Alaska. Included in the proposal are a complete listing of equipment requirements and its costs. Also actual photographs of vegetation along the railroad are included, divided by OAC for the purpose of the project into four distinct areas because of growth factors and types of vegetation. The expense of keeping the right-of-way clear of weeds in future years is predicted. Oregon Agricultural Chemicals will supply the equipment and herbicides for the job and Mr. Greene will instruct the railroad personnel who will perform the actual application. Next fall, Mr. Greene plans to survey the results and set up the program for the following season.

The agricultural section operates in much the same way, although not usually on so large a scale. Men are maintained and stationed in California, Nevada, Wyoming, and northern Oregon to give customers personal service. Oregon Agricultural Chemicals conducts consistent training schools for its employees, sometimes sponsored by chemical companies and other times by OAC itself.

In an effort to keep paper work at a minimum, OAC has

W. E. Greene, left, and Everett Jones, retail store manager, display the Spray Center's collection of scale model bugs that are exact replicas to make identification easy for customers. A complete line of pesticides is displayed under the counter and behind Mr. Jones is an array of nozzles and spray fittings.

evolved a customer card file that lists the types of calls each customer desires, such as weed control, insect control, or soil fumigation, and the time of year for such calls. The field representatives are equipped with transistor dictaphones into which they report each call, telling the time, the potential for pest control work, and the complete address. This information is transferred to file cards in the Tulelake office that are used to prepare mailing lists and indicate whether the customer is a local farmer, a dealer, or an industrial concern. Besides keeping paper work at a minimum, Mr. Greene's dictaphone system enables his field men to remain on the job, eliminating frequent visits to the home office. They are able to dictate letters or reports while traveling and can make surveys, analyses, and proposals in the field.

Schedules for customer calls are arranged on the basis of information contained on the cards. The company spends 80 per cent of its time servicing its regular customers. The other 20 per cent is devoted to developing new business. Oregon Agricultural Chemicals has established a growth rate of 15 to 20 per cent per year and plans not to exceed that rate. The growth is based on expanding the services to existing customers. New customers usually are contacted through the firm's regular clients.

An interesting phase of the company's customer relations program is its calendar series. The calendars, complete with pin-up type illustrations, are issued monthly to regular customers. In addition to a pretty face, the calendars carry a message about the company's operations. This year, for instance, key personnel and general programs are described each month. The calendars are prepared by Mr. Greene, himself, with the assistance of Garwood Walp, head of the agricultural department, and Bud Kane, who works with the industrial department. The calendars, by the way, have won an Outstanding Industrial Advertising Award at the Chicago Direct Mail and Calendar Exposition. They have been issued regularly each month for the past eight years.

Mr. Greene, who conducted a nursery and landscaping business in Klamath Falls, Oregon, in 1940, opened Greene's Spray Center, forerunner to Oregon Agricultural Chemicals, in Tulelake in 1945. Mr. Greene's wife, Nona, works with him in the operation of the Spray Center, as the company's headquarters still is known. OAC tests all new pesticides on its own plots and on small plots of customers. In this manner, they become familiar with the most efficient pest control methods and are able to put them to work for the small farmer. Mr. Greene feels it is not enough just to put chemicals on the shelf for people to learn to use the hard way.

Besides hundreds of farmers, OAC's customers include a dozen power companies, hundreds of mills, 28 railroads, 25 irrigation districts, and almost 200 dealers. They offer a complete selection of pesticides and specialized products as well as application equipment. Personnel of the company are cross-trained to be able to handle several jobs. Three of the office staff, for instance, hold Oregon applicators licenses. "We are a small business," Mr. Greene said recently," maintaining a staff of

(*Continued on Page* 123)

Checking customer cards in the firm's main office are (left to right); Manager Dallas Schiewe, Bernice Holbrook, Accountant; and Edward Sullivan, storeman. Photo at top of page shows the modern building that houses the Spray Center in Tulelake, Calif. Mr. Greene is shown with the firm's panel truck.

Pest killers you can safely use and recommend!

DITHANE M-22 (maneb) is the newest and most effective fungicide in the DITHANE family . . . the most versatile and widely used of all agricultural fungicides. If you haven't yet tried this proved fungicide on a wide variety of fruits and vegetables, you're in for a pleasant and profitable surprise.

KELTHANE miticide is today's most effective and longest-lasting protection against troublesome mite species, including "resistant" strains. New lower cost makes KELTHANE your best bet for safe, sure control of mite populations in fields, orchards and groves.

DITHANE Z-78 (zineb) is the No. 1 fungicide for controlling Greasy Spot and Russeting on citrus fruits. Sulfur applications are unnecessary when you concentrate on DITHANE Z-78 . . . the safe, easy-to-use citrus fungicide.

See your Rohm & Haas field man . . . or write direct for complete information on these pesticides, as well as PERTHANE, RHOTHANE and LETHANE insecticides; KARATHANE fungicide; and TRITON spreader-sticker.

DITHANE, KELTHANE, PERTHANE, LETHANE, RHOTHANE, KARATHANE *and* TRITON *are trademarks, Reg. U.S. Pat. Off. and in principal foreign countries.*

Chemicals for Agriculture

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Small heliport loading sites are set up on most banana plantations in Ecuador so pilots can move rapidly from job to job.

A helicopter syraying a banana plantation to control Sigatoka disease. A combination of fungicide and oil is being used to control the disease which threatened Ecuador's major export trade.

Helicopter Spraying in Ecuador

by Carrol M. Voss
President of Agrotors, Inc.,
Gettysburg, Pa.

A COMBINATION of helicopters and low-volume, oil based fungicides has shown promise for Sigatoka disease control in the banana growing areas of Ecuador. The disease has been present in the Western Hemisphere for many years and has been controlled before, but only at considerable expense and difficulty.

Major Central American banana producers have spent millions of dollars installing pipe lines and perfecting systems for the application of copper sulfate sprays. The large number of small farms in Ecuador, however, make elaborate piping systems impractical. Moreover, the rolling terrain restricts the use of tractor-drawn spray rigs and airplanes. Prior to the helicopter and concentrated sprays, therefore, the only effective answer to Sigatoka in Ecuador had been the abandonment of infected plantings and the establishment of new ones.

In the past ten years, Ecuador has risen to world leadership in the banana trade. Exports, which averaged three million stems in 1945-49, rose to 18.7 million in 1952 and were over 26 million by 1955.

Sigatoka disease, or banana leaf spot, first appeared in Java in 1902 and in the Caribbean area in the early 1930's but was not a factor in Ecuador until 1950. By 1952, one of the largest banana plantations in Esmeraldas, Ecuador was at the point of being abandoned because of the disease. An example of the seriousness of Sigatoka disease can be found in Mexico where banana production dropped from 12,000,000 stems in 1938 to 1,784,713 in 1955, entirely as a result of failure to control Sigatoka. The disease causes the destruction of the leaf surface of the banana plant, making it impossible for the plant to produce a bunch of bananas of the size

and quality necessary for the export market.

As much as 200 to 250 gallons of Bordeaux mixture had been applied to each acre of bananas by the large corporation farms in other areas, but the small farmers of Ecuador needed a method which would be less costly and involved.

Following numerous surveys carried out by government agencies, private companies, and technicians of the Servicio Cooperativo Interamericano de Agricultura, the agricultural point four program in Ecuador, a research project involving the helicopter was proposed. We went to Ecuador in October, 1954 to survey the plantations and made final arrangements for the use of the helicopter in 1956. By then, Dr. Russell Desrosiers, a plant pathologist for SCIA, had made considerable progress in the development of low-volume spraying techniques applicable to Ecuadorean conditions and involving the application of from one to three gallons of liquid per acre. Helicopters International, Inc., at its Gettysburg, Pennsylvania, base, meanwhile, had developed special mist-blowing equipment for applying finely atomized concentrated fungicides or spray oil combinations for complete plant coverage.

Discussing the spray project are (left to right): Dr. Russell Desrosiers, plant pathologist, SCIA; Dr. Voss, the author; and Vincent Colicci, chief mechanic for Helicopters International.

Investigators in the French West Indies found that control of the disease could be obtained with fungicides applied in oil with airblast mist blowers; the use of oil alone appeared to control the disease. This development provided a great impetus to the investigation and was directly transferrable to application by helicopter.

Using the results of this preliminary work, Dr. Desrosiers was able to have everything ready for the initial tests when we arrived in Ecuador with the first Bell helicopter sprayer in September, 1956. The machine was contracted to the Association National de Bananeros del Ecuador, a recently formed banana growers association, and SCIA for a one-year period. The base location was at Pichilingue, the Tropical Agricultural Experiment Station of SCIA. Test and demonstration plots were laid out there and on several other plantations.

The first spraying took place in October, 1956. Thirty-nine treat-

(*Continued on Page* 125)

TRITHION® Now Registered for Use on 36 Crops

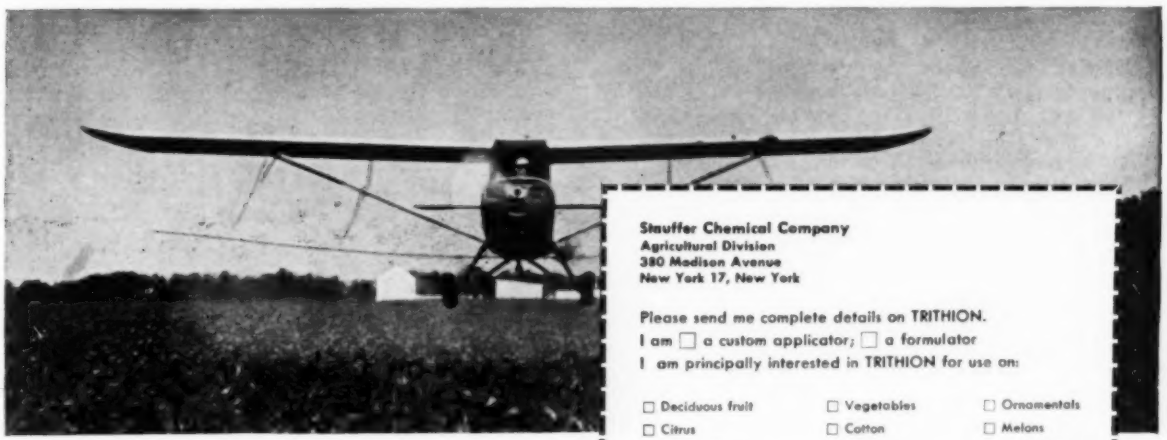
Extensive field use on many crops throughout the United States confirms the outstanding advantages of TRITHION, miticide-insecticide.

It has long residual action . . . is economical because fewer applications are required . . . is less hazardous to apply than many organic pesticides . . . is compatible with most other pesticides . . . and is especially effective against mites, aphids, scale insects, plus many other insects such as Mexican bean beetle, codling moth, various "hoppers," etc.

TRITHION 4 Flowable, a special water emulsion containing 4 pounds of TRITHION per gallon, combines the good spreading qualities and low plant injury of a wettable powder with the ease of handling, high degree of suspensibility and stability of a liquid concentrate. TRITHION 25% Wettable Powder is excellent for use where growers prefer this type of formulation.

Formulators and custom applicators can use TRITHION 25% Dust Base or 25% Wettable Powder for formulating their own dusts containing 2% or 3% TRITHION. These dusts are stable, highly effective, and can be formulated in combination with most other insecticides and fungicides.

Fill in and mail the coupon below for full information on TRITHION. Stauffer Chemical Company, 380 Madison Avenue, New York 17, New York. Sales and service offices throughout the country.



Stauffer CHEMICALS SINCE 1885

One of the world's largest specialists in farm chemicals.

®TRITHION is Stauffer Chemical Company's trade-mark (registered in principal countries) for *0,0-diethyl S-p-chlorophenyl thiomethyl phosphorodithioate*, an insecticide-miticide.

Stauffer Chemical Company
Agricultural Division
380 Madison Avenue
New York 17, New York

Please send me complete details on TRITHION.
I am ☐ a custom applicator; ☐ a formulator
I am principally interested in TRITHION for use on:

☐ Deciduous fruit	☐ Vegetables	☐ Ornamentals
☐ Citrus	☐ Cotton	☐ Melons
☐ Berries, Grapes	☐ Nut Crops	☐ Seed Crops

NAME.....
(Please print)

FIRM.....

ADDRESS.....

CITY.....ZONE.....STATE.....

DUSTING WITH ZINC ETHYLENE 30 LBS./ACRE

HERE'S REAL DUSTING!

WITH THE REMARKABLE NEW

SELLERS Swathmaster

Dusting with a Swathmaster equipped airplane gives you a thorough penetration of chemical into the crop and *at a more uniform material flow* and *a wider swath* than can be obtained from conventional spreaders.

This results in a better job for the farmer and, because of the more efficient applicating techniques used, a greater profit for the ag operator.

For example the C.A.A. approved Swathmaster can evenly apply high or low volume dusts, 10-60 lbs./acre at 50 ft. swath widths. Pelletized fertilizers can be applied at 100-1,000 lbs./acre at 96 ft. swath widths; light alfalfa seed, 5-30 lbs./acre at 66 ft. swath widths; and rice, 150-500 lbs./acre at 96 ft. swath widths (or at half these swath widths for double coverage).

And by a simple control resetting requiring a few seconds only, the versatile Swathmaster can be prepared for the next job to apply liquids ranging from 1-180 gallons/acre, *without any aerial applicating time lost* for equipment change-over, modification or maintenance!

Write, phone or wire today for the brochure which tells how the Swathmaster can increase your applicating efficiency and reduce your overhead.

MOTION PICTURE

SHOWS CLOSE-UPS AND EXCELLENT DUST AND SPRAY APPLICATING SCENES. IT IS 16 MM., SOUND AND COLOR. 15 MINUTES RUNNING TIME. LOAN COPIES AVAILABLE.

BROCHURE

FREE EIGHT PAGE ILLUSTRATED BROCHURE DESCRIBES PROFIT POTENTIAL, ITS PERFORMANCE, HOW IT WORKS AND INSTALLATION DETAILS.

U.S. PATENT 2,772,061 AND MEXICAN PATENT 59,033

MANUFACTURED AND DISTRIBUTED BY

TRANSLAND AIRCRAFT

2600 WEST 247TH STREET • TORRANCE, CALIFORNIA

TELEPHONE: DAVENPORT 61681

ALSO DISTRIBUTED BY

SELLERS AVIATION INC.
1515 CRESTMONT DRIVE
BAKERSFIELD, CALIFORNIA
PHONE: FAIRVIEW 2-5184

Louisiana Pilots Discuss Control Recommendations

by Kirby L. Cockerham

Louisiana Agricultural Extension Service

ALMOST 2,500 aircraft and 2,000 pilots applied 367 million pounds of chemicals to more than 19 million acres in eleven Southern states during 1957, the fourth annual Louisiana Aerial Applicator's Conference was told by J. J. Werbke, agricultural specialist for the Federal Aviation Agency, Fort Worth, Texas. Mr. Werbke reviewed the development of aerial application of chemicals for the group.

The meeting was held at Louisiana State University, Feb. 6 and 7, and was attended by more than 75 pilots and flying service operators. In his talk, Mr. Werbke cautioned pilots about the hazards of aerial application and urged that they always use shoulder harnesses, crash helmets, and safety belts.

George C. Cavin, of the USDA's Plant Pest Control Division at Gulfport, Miss., spoke on aerial application of granular insecticides. He described swath width, speed, altitude, and the ground patterns of granular insecticides obtained under varying conditions, as well as the changes necessary to convert a plane from dust or liquid to granular applications. Mr. Cavin pointed out that during 1958 more than 150,000 acres of land in Louisiana were treated with granular insecticides to control the imported fire ant. E. A. Cancienne of the Louisiana State Department of Agriculture reported that 40,000 additional acres are being treated or are scheduled for treatment during the early part of 1959.

A panel comprised of Dr. Henry Long, research entomologist; Sterling Deville, county agent; and Roy S. Crandall, pilot, discussed sugar cane insect control. They reported that excellent results had been obtained with endrin, which had been recomended in 1958 for the first time, to control the sugar cane borer. It was brought out in the discussion, however, that pilots were not told that the insecticide might kill fish and had not made any special efforts to avoid spraying over water. As a result, some fish reportedly were killed during last year's applications. The panel reported that proper precautions now are being exercised and danger to fish is being avoided.

Cotton insect control recommendations were presented by Dr. J. S. Roussel, research entomologist, who said that cotton growers must time their applications so as to get the greatest amount of insect control from the fewest number of applications. He further stated that early control of boll weevils is likely to encourage later outbreaks of boll worms and aphids.

Dr. L. D. Newsom and Dr. Daniel Clower of the experiment station discussed research on rice insect control and insect damage on corn. E. A. Epps, Louisiana State Chemist, told of the uses and hazards of new insecticides and John B. Baker reported new developments in weed control. Insurance for planes and operators was discussed by A. L. Neely, Jr.

The director of the LSU forestry department, Dr. Paul Burns, spoke on forestry research and told the pilots that they are living in a changing agriculture and are faced with agricultural surpluses, price controls, acreage allotments, price supports, and soil banks. Dr. Burns reminded his audience that they are losing acreage in crops that they had been accustomed to treat-

(*Continued on Page* 134)

Top left: J. J. Werbke, Federal Aviation Agency, Fort Worth, Texas; top right: Mrs. William A. Rose, Mr. Rose, W. R. Reinhart, and E. C. Hansen in informal discussion; bottom left: Bob Baumnitz, Tallulah, La., 1958 president, and Walter Broussard, Jennings, La., outgoing secretary of the association; bottom right: John B. Baker, Louisiana Agricultural Experiment Station.

PEST ROUNDUP

By Kelvin Dorward

This column, reviewing current insect control programs, is a regular feature of AGRICULTURAL CHEMICALS. Mr. Dorward is head — Survey & Detection Operations, Plant Pest Control Division, U. S. Department of Agriculture. His observations are based on latest reports from collaborators in the U.S.D.A.'s pest surveys throughout the U. S.

General Insect Activity

ALTHOUGH spotted alfalfa aphid populations have not been high during the winter, the distribution has been interesting. The insect was found as far north as Halifax County, Virginia, during late January. Populations during the 1958 growing season were relatively light in the state. The spotted alfalfa aphid was also active throughout the winter in Kansas. During the last day of January, high counts per 25 plants were given for the following Kansas counties: Riley 18, Geary 103, Marion 52, Butler 315 and Cowley 334. In addition, light populations were also recorded during February in Barton, Pawnee and Hodgeman Counties. Populations were light in Oklahoma, with 75 per square foot being recorded in 4-5 inch alfalfa in Bryan County. Some alfalfa fields in Payne County had an average population of 504 per square foot.

Several heavy infestations of the spotted alfalfa aphid were found on non-resistant varieties of alfalfa in Eddy and Lea Counties, New Mexico. Light to moderate infestations were recorded in southern and southeastern counties. Some control measures were applied. In Maricopa County, Arizona, the aphid was present, but controls were not necessary. Populations in Yuma County were on the increase.

The pea aphid, by the latter part of February, was building up in several states. Infestations on alfalfa were medium, but increasing in Yuma, Maricopa and Pinal Counties, Arizona. Populations were heavy and injuring alfalfa in areas of Eddy, Chaves, DeBaca and Dona Ana Counties, New Mexico. Some growers were applying controls. Light populations were recorded during February in Arkansas and Kansas.

By the latter part of February, the winter grain mite was being reported. Heavy damage to oats was caused by the mite in Dallas County, Texas. Scattered populations averaged 25 mites per linear foot in small grain fields in Bryan County, Oklahoma. One field in the Enid area, however, averaged over 200 per linear foot. The greenbug was light in all states reporting on the pest, except Texas, where slight damage was recorded in fields of Dallas County. The insect was not found in six Kansas counties surveyed during the latter part of February.

A limited grasshopper egg survey in 12 Texas panhandle counties showed egg pods to be in good condition, with predators and natural enemies few.

The vegetable weevil was heavy on turnips in East Baton Rouge Parish, Louisiana, in late February. The insect attacked newly set lettuce in New Hanover County, North Carolina, early in the month. The green peach aphid required controls in all sugar beet fields grown for seed in the Salt River Valley of Arizona. In southern California, the strawberry aphid built up to damaging numbers as a result of warm weather and little rain. In that state, the seed-corn maggot damaged spinach in Orange County. Spinach was also damaged in Zavala and Dimmit counties, Texas, by the same insect. Controls were applied in the Texas counties as a preventive measure. The tobacco flea beetle and the vegetable weevil were present in light to moderate numbers on tobacco in several Georgia counties. The potato tuberworm and yellow-striped armyworm were on tobacco plants in West Palm Beach County, Florida.

Although fruit insect activity during February was light, a check in Bernalillo and Sanoval Counties, New Mexico, showed overwintering larvae of the codling moth to be abundant under the bark of apple trees.

Among insects affecting man, mosquitoes were very prominent in Florida. In January, mosquito populations increased in Brevard County, and peak populations continued in the Indian River area. Of unusual interest, was the report during February of the tropical rat mite causing dermatitis to some humans in some rural areas of Tillman County, Oklahoma.

Increase Insect Detection Efforts

WITHIN the past several years, various agricultural agencies have gone on record requesting increased emphasis on plant pest detection. The increased interest in this phase of plant pest control has undoubtedly been stimulated by recent sucesses on some of the large scale eradication programs, such as the Mediterranean fruit fly in Florida.

The agencies asked for a co-

operative detection program coordinated and directed at the national level. The Plant Pest Control Division, also recognizing the great need for this work, has acknowledged the requests, by establishing a position within its Survey and Detection Operations devoted to detection of insects not known to occur in the United States, and to detection of economically important insects not known to occur in certain parts of the United States. Mr. E. D. Burgess, director of the division, announced recently the initiation of this program.

In keeping with the discussion here on detection, it will be of interest to review the new records reported during the past year. In 1958, there were 30 new state records reported involving 28 species of insects and mites. Some of the more important new finds were the alfalfa weevil in Georgia and Rhode Island, spotted alfalfa aphid in Washington and Oregon, smaller European elm bark beetle in Nevada, black pecan aphid and spruce bud scale in California, clover seed weevil in Illinois and Utah, birch leaf miner in Indiana, mimosa webworms in Florida, and rice delphacid, vector of hoja blanca disease of rice, in Mississippi. Many of the species involved in the spread to new areas in 1958 were pests that have been introduced into the country over the years.★★

•

Pest Control Meeting

The next meeting of the Indiana Pest Control Operators Association will be held in Atherton Hall, Butler University, Indianapolis, on April 18.

•

NATA Ag. Aviation Survey

The National Aviation Trades Association, Washington, D. C., has started mailing the questionaires for its survey of agricultural aviation. The survey will include all aerial applicators, not just NATA members, and will cover 1958 operations.

Aerial Hardwood Control

Effective and economical control of undesirable woody plants without damage to pine is indicated through cooperative research on aerial spraying conducted by the U. S. Department of Agriculture and Louisiana State University.

The most effective treatment for hardwood control found in the tests was with a low volatile ester of 2,4,5-T, applied in an oil-water emulsion at the rate of five gallons per acre in the late spring.

At a cost of $7.50 to $9 per acre, the treatment gives effective control of blackjack oak, post oak, and sweetgum. It provides fair to good control of red oak and blackgum; fair control of hickory and white oak; and poor control of red maple and water oak.

Better kill is obtained on ridges and slopes than in creek bottoms because the more susceptible species commonly are found on ridges and the more resistant species in bottoms.

Fred A. Peevy of the USDA's Agricultural Research Service and Paul Y. Burns of Louisiana State conducted the tests.

•

E.A.A.C. Quarterly Booklet

The European Agricultural Aviation Center, The Hague, Netherlands, has published the first issue of its quarterly periodical, "Agricultural Aviation." Offered in two editions, in English and in French, the booklet contains articles and information of interest to aerial applicators on a worldwide scale.

The first issue contains articles on aerial potato spraying in England and forest spraying in Germany, together with descriptions of new types of agricultural aircraft and equipment.

The E.A.A.C. is an independent, international organization whose aim is the promotion of the use of aircraft and helicopters in European agriculture and forestry.

Arcadian® News

Volume 4 | For Manufacturers of Mixed Fertilizers | Number 4

Are You Taking Full Advantage of Nitrogen Division Service?

During your rush season and in any season, Nitrogen Division, Allied Chemical, is better equipped than any other nitrogen producer *to serve you.* Here are three important reasons why—

1 Technical Assistance

To provide its customers with competent, well-qualified technical assistance, Nitrogen Division maintains the largest, best-trained, most-experienced staff of fertilizer technologists in the industry. This staff includes hundreds of fertilizer technicians, scientists and engineers working with millions of dollars worth of laboratory and pilot plant equipment.

These men are ready, willing and able to help you find the practical answer to your formulation, ammoniation and manufacturing problems. The accumulated skill of many years of experience augments your own efforts. And this service is available to customers without charge.

Nitrogen Division technical men work on your problem in your plant or in their laboratories using the most modern facilities. They are skilled in ferreting out trouble spots and in helping you to quickly correct operating techniques.

Remember, Nitrogen Division technologists originated and developed nitrogen solutions and the practice of ammoniating superphosphate. They have the *know-how* that counts when you need help fast!

2 Production Capacity

Long-time leading producer of fertilizer nitrogen, Nitrogen Division owns and operates three huge plants—at Hopewell, Virginia; South Point, Ohio; and Omaha, Nebraska—by far the biggest nitrogen production capacity in the country. And, Nitrogen Division offers the most complete line of nitrogen products available to the fertilizer manufacturer.

Look over the list of ARCADIAN® Nitrogen Solutions and other ARCADIAN Nitrogen Products on page 4 of this issue of ARCADIAN NEWS. No other nitrogen producer is so well prepared to supply your complete nitrogen needs. You can get the exact nitrogen products you want from Nitrogen Division—and *all* your nitrogen from one source.

3 Delivery Facilities

Getting your order to you on time for you to meet production schedules is standard procedure for Nitrogen Division. Its three plants are strategically located for fast shipment to fertilizer manufacturers, with the aid of the largest fleet of tank cars in the industry plus many tank trucks. A widespread network of "in-transit" storage points is maintained, where fully-loaded tank cars sit on railroad sidings ready to move immediately for fast deliveries.

All Nitrogen Division facilities are closely linked by teletype, direct private phone and other methods of rapid communication. Every provision is made to expedite your orders—to get your nitrogen rolling to you immediately.

Nitrogen Division has the products and the people to serve you best! Why not see how well this service operates? Contact: Nitrogen Division, Allied Chemical, 40 Rector Street, New York 6, N. Y. Phone: Hanover 2-7300. Or call one of the 12 other offices listed on page 4 of this issue of ARCADIAN NEWS.

Arcadian News for Fertilizer Manufacturers . . . . . from NITROGEN DIVISION

Grazing and Silage Crops Thrive on 2-1-1 Ratios

Don't let the outstanding success of 2-1-1 ratio fertilizers for corn blind you to the late spring opportunities for extra sales on *other* grass crops. Yes, corn is a specialized kind of grass. Other grass crops are like it in needing high-nitrogen mixed fertilizers to produce big, profitable yields.

When you provide your dealers with 16-8-8, 14-7-7 and other top-notch corn fertilizers, advise them to top off the corn season with the grass market. Sure, early spring is the time many pastures are fertilized. But they need nitrogen and other plant food again after the first flush of growth has been grazed or cut.

When high-nitrogen fertilizer can make grass produce 6 to 8 tons of milk per acre, and 400 to 800 pounds of beef per acre, there's money in fertilizing the crop. It will pay to get your share of it. Remember, most farmers get less than a ton of milk per acre of ordinary pasture, and 75 to 150 pounds of beef per acre of ordinary grass.

Grass pastures and hayfields produce the best tonnage of protein-rich feed when they get several applications of fertilizer per year. Instead of a heavy dose of 0-20-20 followed by 2 or 3 nitrogen top-dressing applications, farmers can use a 2-1-1 ratio mixed fertilizer three times a year. May and early June, after the first crop is off, is a fine time to get mixed fertilizer on grassland. Demonstration strips fertilized with 16-8-8 or similar fertilizer will open the eyes of many a farmer to his need for grassland fertilizer.

Summer grazing crops, like sudan grass and millet, yield tons of good feed per acre when they get fertilizer. Your 2-1-1 mixed fertilizers are ideal to make these warm-weather crops get up and grow.

PROPOSED CHANGES IN FERTILIZER GUARANTEE LAWS

Bills have been introduced in the State Legislatures in Maine and Minnesota, which, if approved, would require that the phosphorus and potash content of fertilizer be guaranteed on an elemental rather than the present oxide basis. Plans to introduce similar bills this year are reported to be under way in several other states. Preliminary hearings have already been held on the proposed changes by the Maine and Minnesota legislatures. Little, if any, publicity has been given to this activity in trade papers and it is reported that few fertilizer manufacturers had representatives present at preliminary hearings.

It behooves all fertilizer manufacturers to follow this development closely. If you market within a state in which elemental guarantees have been or will be proposed, you will want to evaluate the effects of such changes on your business and keep State Legislatures and trade associations advised of your position.

Technical Tips

QUALITY CONTROL

In the early years of the fertilizer industry, the producer got just as much quality out of his production as he put into it. In fact, the long "curing" process that was the custom, then, often *improved* the product.

But this is no longer true. Today, the use of new and more concentrated ingredients to make higher analysis fertilizers *plus* the emphasis on speed to fill volume orders, has made quality more elusive. If equipment and techniques are not carefully watched and maintained for peak performance, finished goods will not contain *all* the nitrogen that is put into the mix. The producer should not delude himself into thinking that the mere adding of costly, complicated equipment and certain new materials will solve his quality problem. It may, if he's not careful about operation, simply create new and more serious difficulties.

Common Errors in Technique

One of the traps that the unwary producer may fall into is the striving for low moisture content of granulated fertilizer by permitting excessive heat in the storage pile. This can result in "bag set"—the very thing the producer is trying to avoid through low moisture content. In addition, if carried to extremes, this preoccupation with minimum moisture can cause release of undesirable fumes from the dryer, with some loss of nitrogen.

Another common fault is to attempt to save time by speeding up the ammoniation process. The problem is that in high rates of ammoniation, the heat of the mass causes the last portion of nitrogen solution being introduced to give up its ammonia in the form of gas. For obvious reasons, this is the part of the action that cannot be hurried in any system, and still maintain adequate control. Unfortunately, this time period is the most obvious to producers, and the one they usually try to shorten to speed up mixing time. They would be better advised to save time by adding the *first* portion of the ammoniating medium more rapidly. This can be done in most systems, including continuous types.

Still another error is to try to save time by not using the holding hopper ahead

of the batch mixer. This can only lead to robbing essential operations of vital time allotments.

Some producers actually go so far as to remove screens to speed up production. As a result, the lumps of ingredients deprive the process of the intimate contact on which so much depends. Where the lumps are superphosphate, the effect on ammonia take-up, as well as on physical quality, is well-known. Even with screening, an unreasonably fast operation with very lumpy materials can cause irregular concentration in the mass. What happens is that too long a holdup at the sizing mill prevents some of the materials from returning to the batch in time.

Let Sampling Help, Not Hinder

If the physical mixing and chemical combining of mixed fertilizer were 100% efficient, then undisciplined (easy-way) sampling would be acceptable. But the pressure for tonnage alone is such that perfection in these two areas is not compatible with the other economics of the fertilizer business. Thus, as operations depart further from perfection, the operator is forced to rely more and more on sampling as a check on his production. It goes without saying that the producer should make every effort to sample *correctly*.

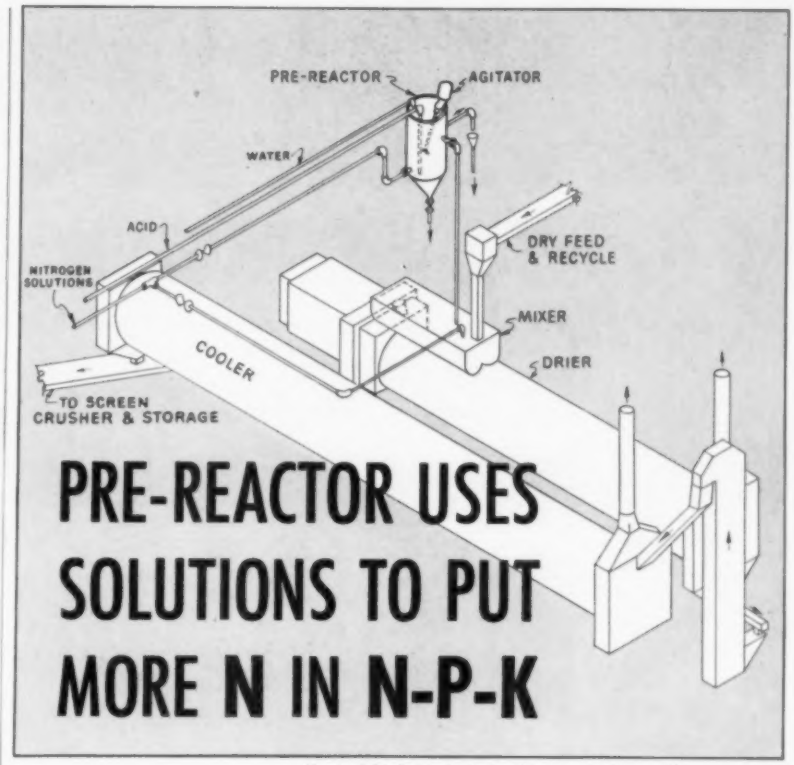
For example, when sampling every batch, the producer should be careful not to take samples from the same region of the discharge every time. Obviously, the analysis of this total sample indicates only the amount of plant foods in that particular portion of the batch, which may or may not be representative of the entire mass.

Again, taking several samples during the discharge of a single batch is almost as bad a practice. Here, the total sample usually contains an unduly large proportion from the slow discharge rate part of the cycle. So, take your samples properly, and they will give you a true picture of what you are producing.

Weather Forecasts

Nitrogen Division has begun distribution of monthly weather forecasts to its customers all over the country. The forecast for each month will be mailed about a week before the month begins. Weather is one of the most important factors in the fertilizer business and the new service should be helpful in making plans.

The forecasts, said to be 80% accurate, are prepared for Nitrogen Division by Weather Trends, Inc., one of the oldest private weather forecasting services in the nation. In addition to a summary giving over-all weather predictions, each forecast will include colored charts and maps showing expected precipitation and temperatures in each section.



Typical high-analysis fertilizer operation with pre-reactor.

Until recently, getting maximum use out of nitrogen solutions in making high-analysis fertilizer has been limited by the amount of acid that could be added to the mix without developing excessive heat in the liquid phase. But now, with the new technique of using a *pre-reactor*, every producer can formulate 2-1-1, 3-2-2 and other high ratios with safety and precision.

No Acid in the Mix

This new technique involves keeping all acid out of the mix—confining it to the pre-reactor, along with the nitrogen solution. Here, the acid neutralizes the free ammonia in the nitrogen solution. The heat generated by this reaction is dissipated through evaporation of water by the pre-reactor. In some formulations this function of "drying out" in the pre-reactor assumes even greater importance.

Makes Production More Precise

The pre-reactor has further value in that it gives the producer greater control over heat and water content in the mix. By adding water to the pre-reactor at an easily determined rate, he can maintain a constant temperature that provides a slurry of uniform nitrogen and water content to feed the mixer. In effect, by using a pre-reactor, the producer can efficiently neutralize all the ammonia in excess of that which is necessary for ammoniation of the superphosphate. In view of this, it is obvious that the new pre-reactor technique will prove to be a most valuable aid in the producer's never-ending fight to maintain quality in volume production.

Cuts Costs, Increases Profits

In addition to the foregoing benefits in safety, precision and greater control, the use of a pre-reactor gives the producer a unique economic advantage. For, getting all his nitrogen from low-cost Arcadian Nitrogen Solutions can add a big plus to net profits. As the sketch shows, there is nothing complicated about incorporating a pre-reactor in a normal high-analysis granulation operation. The same standard equipment is used . . . nothing is eliminated. Take advantage of the new pre-reactor technique for making high-analysis fertilizers . . . you'll *like* the difference in your volume, quality and profits! For complete details—without obligation—on how to put a pre-reactor into your present granulation setup, write: Technical Service, Nitrogen Division, Allied Chemical Corporation, 40 Rector Street, New York 6, N. Y.

HERE'S THE BIG LINE OF Arcadian® NITROGEN SOLUTIONS

When you purchase your nitrogen requirements from Nitrogen Division, Allied Chemical, you have many different nitrogen solutions from which to select those best suited to your ammoniation methods and equipment. You are served by America's leading producer of the most complete line of nitrogen products on the market. You get formulation assistance and technical help on manufacturing problems from the Nitrogen Division technical service staff. You benefit from millions of tons of nitrogen experience and the enterprising research that originated and developed nitrogen solutions.

	CHEMICAL COMPOSITION %						PHYSICAL PROPERTIES		
	Total Nitrogen	Anhydrous Ammonia	Ammonium Nitrate	Urea	Water	Neutralizing Ammonia Per Unit of Total N (lbs.)	Approx. Sp. Grav. at 60°F	Approx. Vap. Press. at 104°F per Sq. In. Gauge	Approx. Temp. at Which Salt Begins to Crystallize °F
NITRANA®									
2	41.0	22.2	65.0	—	12.8	10.8	1.137	10	21
2M	44.0	23.8	69.8	—	6.4	10.8	1.147	18	15
3	41.0	26.3	55.5	—	18.2	12.8	1.079	17	-25
3M	44.0	28.0	60.0	—	12.0	12.7	1.083	25	-36
3MC	47.0	29.7	64.5	—	5.8	12.6	1.089	34	-30
4	37.0	16.6	66.8	—	16.6	8.9	1.184	1	56
4M	41.0	19.0	72.5	—	8.5	9.2	1.194	7	61
6	49.0	34.0	60.0	—	6.0	13.9	1.050	48	-52
7	45.0	25.3	69.2	—	5.5	11.2	1.134	22	1
URANA®									
6C	43.0	20.0	68.0	6.0	6.0	9.3	1.180	12	39
6M	44.0	22.0	66.0	6.0	6.0	10.0	1.158	17	14
10	44.4	24.5	56.0	10.0	9.5	11.0	1.114	22	-15
11	41.0	19.0	58.0	11.0	12.0	9.2	1.162	10	7
12	44.4	26.0	50.0	12.0	12.0	11.7	1.087	25	- 7
13	49.0	33.0	45.1	13.0	8.9	13.5	1.033	51	-17
15	44.0	28.0	40.0	15.0	17.0	12.7	1.052	29	1
U-A-S®									
A	45.4	36.8	—	32.5	30.7	16.2	0.932	57	16
B	45.3	30.6	—	43.1	26.3	13.5	0.978	48	46
Anhydrous Ammonia	82.2	99.9	—	—	—	24.3	0.618	211	-108

Other ARCADIAN® Products: URAN® and FERAN® Solutions • Ammonia Liquor • N-dure® A-N-L® • Ammonium Nitrate • UREA 45 • Nitrate of Soda • Sulphate of Ammonia

NITROGEN DIVISION

Allied Chemical

MAIN OFFICE: 40 RECTOR ST., NEW YORK 6, N. Y., PHONE HANOVER 2-7300

Hopewell, Va., P. O. Drawer 131 ..... Glenview 8-6301
Ironton, Ohio, P. O. Box 98 ..... Drexel 7-4366
Omaha 7, Neb., P. O. Box 166 ..... Bellevue 1464
Raleigh, N. C., 16 W. Martin St. ..... Temple 3-2801
Columbia 1, S. C., 1203 Gervais St. ..... Alpine 3-6676
Atlanta 3, Ga., 127 Peachtree St., N. E. Jackson 2-7805
Memphis 9, Tenn., 1929-B South 3rd St. Whitehall 8-2692
Columbia, Mo., 1134 Highway 40W ..... Gibson 2-4040
Indianapolis 20, Ind., 6060 College Ave. Clifford 5-5443
Kalamazoo, Mich., P. O. Box 869 ..... Kalamazoo 5-8676
St. Paul 14, Minn., 764 Vandalia St. ..... Midway 5-9141
San Francisco 4, Cal., 235 Montgomery St. Yukon 2-6840

Two days of instructions on pest control and business management for applicators preceded the demonstrations of aerial equipment. At the right, a Grumman Ag-Cat is being loaded prior to take-off for a demonstration flight.

Pest Control Short Course Feature Of Texas Meeting

THE eighth annual Texas Agricultural Aviation Conference, Feb. 22 to 24, was featured by two days of instruction on insects, plants, and soils and a day-long demonstration of aerial application planes and equipment. The conference was held at Texas A&M College at College Station, Texas.

Among the speakers on the program was Dr. L. E. Crane of the Rice Pasture Experiment Station, Beaumont, Texas, who said that the airplane has become an essential farm machine during the past 12 years in the Texas Gulf Coast Prairie. Most of the rice crop in the Beaumont area, he observed, is seeded by air.

The airplane has made possible several of the cultural practices used in the Gulf Coast, he said, but with continued improvements aerial application can be an even more valuable service to rice and livestock producers. Probably the number one problem, Dr. Crane continued, is the need for more uniform distribution of the various materials applied by air.

David R. Fitch, Division of Business Administration, Texas A&M, addressed the group on business management and told his audience that the successful operation of any business today calls for an increasing measure of managerial competence. No longer is it possible, he said, to keep your records in your hat and "fly by the seat of your pants." He quoted Dun and Bradstreet as attributing 91.3 per cent of business failures to unskillful management – inexperience, incompetence, personal extravagance, and speculation.

The successful crop duster-sprayer, Mr. Fitch said, must assemble the right quantity and right type of capital, manpower, and equipment and keep these dollars, men, and machines working efficiently for him or he will soon find himself out of business. The main source of failure, he concluded, is not found in poor professional techniques of spreading chemicals, but from poor business ability in dealing with customers, bankers, and suppliers.

A symposium on insect control was led by Dr. J. C. Gaines of Texas A&M. Dr. R. L. Hanna, department of entomology, described the various cotton insects and their habits and said that the right insecticides properly applied at the proper time do not cost, they pay.

N. M. Randolph of the Texas A&M department of entomology told of insects attacking forage crops. He pointed out that recent increases in yields per acre and market value of forage crops have raised the permissible limit on expenditures for control of the insects that attack them. Basic research in insect control was outlined for the conference by J. R. Brazzel of Texas A&M. He presented examples of basic research being carried on at the college and said that the information obtained in the course of this work may lead to new methods of insect control in the future.

A weed and brush control panel featured a report by Robert A. Darrow, Texas Agricultural Experiment Station, who said that brush control on range lands should be directed toward forage and livestock production and not necessarily towards eradication or total kill of undesirable vegetation.

Bitterweed control with air and ground equipment in 1958 was discussed by Omer E. Sperry, Texas Agricultural Experiment Station. He reported on experiments on bitterweed control that have been carried on by the station over a period of several years. Harlan E. Smith, Texas A&M, discussed plant disease control and said that the best disease control program with many crops should include the use of ground spray rigs supplemented by airplane dusting. Since the spraying gives better control of plant diseases than dusting, he said, ground spray rigs should be used as much as possible. When it is

(*Continued on Page* 123)

Mississippi Group Re-elects Emery

by George E. Bullard
Assistant Professor
Business Administration & Economics
Mississippi State University

CY Emery, Magnolia Aviation Company, Laurel, Miss., was re-elected president of the Mississippi Aerial Applicators Association at the association's annual conference held in Biloxi on February 13-14. In addition, John B. Easter, Johnny Easter Flying Service, Hollandale, Miss., was elected vice-president; and Jack Shannon, Shannon Agricultural Flying, Inc., Clarksdale, Miss., was elected secretary-treasurer. Named to the board of directors were: Ed Osborne, Tunica; L. T. Wade Jr., Rolling Fork; Ben White, Clarksdale; Mabry Anderson, Clarksdale; Ed Traweek; Indianola; Vic Sutter, Greenwood; Dave Harris, Shelby; Felix Whitaker, Redwood; J. O. Dockery, ex-officio, Clarksdale; and Glenn Galteer, pilot director, Laurel.

The Conference was held on Mississippi's Gulf Coast at Biloxi's Buena Vista Hotel. The theme of the meeting was "Cooperation and Research," and it was attended by a representative group of agricultural applicators from all over Mississippi.

Four members of the Mississippi State University staff participated in the conference. They were: Dr. August Raspet, head of the Aerophysics Department; A. G. Bennett, extension entomologist, Mississippi Agricultural Extension Service; Fred L. Shuman Jr., assistant agricultural engineer, Mississippi Agricultural Experiment Station; and George E. Bullard, assistant professor of business administration and economics.

Dr. Raspet addressed the closing luncheon on Saturday noon. He told the applicators about research being done by the Aerophysics Department to improve the flight characteristics of a Stearman airplane and of experiments which have led to more efficient operation for the airplane in connection with aerial application. "We are making further progress in our research and will report to you from time to time on our progress to improve the airplane for applicator use," Dr. Raspet said.

Mr. Shuman spoke about research trends in aerial application and told of the work his department is doing at Mississippi State University. "A legislative appropriation has been made for this research on aerial application, and we expect to make a real contribution to the industry before our work is finished," Mr. Shuman told the group.

"Since we have come about as far as possible in improvement of present methods, the trend in research in aerial application is going to have to be away from what is considered to be conventional equipment. The system that we are working on is a novel idea with which we hope to solve some of the present problems," he further stated.

Mr. Bennett, speaking on "Progress from Cooperation and Better Understanding" told the association members and guests about his work as extension entomologist at the state university, about their methods of training personnel in the field to improve their methods of application, and how the Mississippi aerial applicators could and should work together in disseminating information for better understanding of methods of aerial application within the industry. Mr. Bennett made several printed information bulletins available to the applicators, among them, "Progress Report on Research Conducted in 1958 on Corn Insects;" "Recommendations for European Corn Borer Control;" and "Progress Report on Cotton Insect Control." In addition, Mr. Bennett made available a bulletin entitled "Flagmen and Aerial Application of Agricultural Chemicals," written by John F. Neace.

On Saturday morning, Glenn Galteer, chief pilot, Magnolia Aviation Company, Laurel, and Lee

(*Continued on Page* 123)

LISTENING POST

By Paul Miller

This department, which reviews current plant disease and insect control problems, is a regular monthly feature of AGRICULTURAL CHEMICALS. The comments on current plant disease problems are based on observations submitted by collaborators of the Mycology and Plant Disease Reporting Section, Plant Protection Research Branch, United States Department of Agriculture, Beltsville, Maryland.

Greenhouse Tests of Soil Fungicides for Effectiveness in Control of Seedling Diseases of Cotton

B. W. KENNEDY and L. A. Brinkerhoff, of the Crops Research Division, Agricultural Research Service, United States Department of Agriculture, report results of experiments conducted in cooperation with the Oklahoma Agricultural Experiment Station*. They state that in Oklahoma, as elsewhere, cotton planted during cool or rainy weather often suffers a considerable reduction in stand from seedling diseases. In several states during the past 5 years, application of fungicides with the covering soil at the time of planting the seed has been tried as a means of reducing this loss. Results reported included some failures, but generally a promising degree of control was obtained.

The author's experiments were planned to compare the fungicidal and residual properties of four fungicides, zineb, thiram, captan and pentachloronitrobenzene, in soil (partially sterilized by steaming, and in non-steamed soil in the greenhouse). *Rhizoctonia solani* and *Pythium debaryanum*, two of the most important fungi causing cotton seedling diseases, were used as test pathogens for evaluating the fungicidal effectiveness and residual action of the chemicals. The soil was artificially infested with inoculum from cultures of these fungi, each fungus being used separately in any one plot. Cotton seeds were planted either immediately after the fungicides had been mixed thoroughly with the soil or at different times up to 6 weeks later.

The soil used for the tests was Port sandy loam from fertile bottom land where cotton had been grown for several years. Organic matter content was determined as 0.9 per cent and pH as 6.0.

The cotton seed used in all tests was from a single lot of acid-delinted seed of the Deltapine 15 variety. Plots were single 15 x 18-inch flats planted with 100 seeds, or 6-inch pots planted with 10 seeds. The treatments were randomized and replicated, and results were recorded by methods suited to statistical analysis.

The commercial fungicide preparations (Zineb—65%; Thiram—75%; Captan—50%; PCNB—75%) were used in the form of wettable powders. To apply the fungicides, each was mixed with fine dry sand and then thoroughly mixed with either air-dried or screened, moist soil.

The authors made a preliminary test to determine phytotoxicity of the chemicals. Wettable powder of each fungicide preparation was mixed with non-steamed, uninoculated soil at the following rates: 1 part fungicide to 20,000 parts soil, 1:1,000, 1:5,000, and 1:2,000. The 1:20,000 rate was equivalent to the dosage provided by the 5-pound per acre rate, in field tests in which fungicides had been applied as sprays in the seed furrow and covering soil at the time of planting. Results of this phytotoxicity test indicated the rates of application to be used in the evaluation experiments.

RESULTS:

Phytotoxicity Test — Summer temperatures at the time of the phytotoxicity test in the greenhouse ranged from 75° to 110° F. Under these temperature conditions, which favored rapid germination, none of the fungicides reduced germination percentage seriously. Thiram at the higher rates (1:5,000, 1:2,000) slowed growth a great deal. A considerable amount of chlorosis appeared in the plots treated with captan. When temperatures were favorable for rapid germination, the seedlings emerged about 24 hours sooner in plots treated with captan than in the other plots. This observation agrees with earlier observations in Oklahoma, cited by the authors.

Fungicides Used at Different Rates — In accordance with the results of the phytotoxicity test, application rates for thiram and captan were reduced. Steamed soil in flats was used. After the fungicides were mixed with the soil, the flats were inoculated with *Rhizoctonia solani* or *Pythium debaryanum*. The *Rhizoctonia* culture used proved not to be virulent, and only the results with *P. debaryanum* were reported. Temperatures in the greenhouse ranged

*B. W. Kennedy and L. A. Brinkerhoff, "Comparison of four soil fungicides in the greenhouse for the control of seedling diseases of cotton," Plant Disease Reporter, vol. 43, no. 1, pages 90-97, Jan. 15, 1959.

from about 60° to 80°F and were favorable to the development of seedling disease. Relatively good control was obtained from the captan treatments, but almost none from the others.

Further Tests in Steamed Soil — Steamed soil in 6-inch clay pots was inoculated with one of the test fungi. The pots were kept moist in the greenhouse for 20 days, then the soil was mixed thoroughly with fungicide and repotted, and seeds were planted. Relatively rapid seed germination was favored by the temperature, which was about 70° to 85°F. PCNB was not effective against *P. debaryanum*, but gave moderate control of *R. solani*. Captan at the rate used did not prevent post-emergence damage by either fungus.

Tests of Residual Effectiveness — Non-steamed soil was used for the experiments planned to determine residual effectiveness. In two tests, flats of moist soil mixed with fungicide were held for varying periods of time after treating before inoculation and planting. The soil was kept moist, at temperatures from 65° to 75°F, from the time of treating, until 4 days after inoculation with the test fungi. Temperatures after seedling emergence were about 80° to 110° in the first test, which was made in summer, and 60° to 75° in the second test.

Results obtained during the first summer test are given in Table 1. The *Rhizoctania* isolate used for inoculum was again apparently not virulent, and the Table gives data for *P. debaryanum* only. All the chemicals were used at the same rate, namely 1:20,000. Zineb and PCNB did not give good results, even when used immediately before inoculation and planting. Captan gave good control and was still effective 4 weeks after treatment. Thiram also gave good control, but its effects were not so lasting.

The second test was similar to the first except that environmental conditions differed. Day length was shorter and temperatures were lower, ranging between 60° and 75° F. Under these conditions *P. debaryanum* caused severe post-emergence injury. Mean percentages of seedlings surviving were as follows: in flats treated with captan 42.4, with zineb 13.8, with thiram 9.9, with PCNB 16.1; in the inoculated check flats 0.5; in the naturally infested checks 35.5. Captan again remained effective 4 weeks after application.

In a third experiment the fungicides were mixed with air-dried soil in 6-inch pots. Soil moisture level in the pots was maintained as it would be for growing plants for varying times up to 6 weeks before inoculation and planting. Temperature during this test, including the period of seed germination, was 70° to 85°F. As in the second test, seedling emergence was retarded and severe damage from the pathogens was favored by the low temperatures. In the artificially inoculated soil control was rather poor.

DISCUSSION:

Field observations indicating that PCNB was generally effective against *Rhizoctania solani* but not against *Pythium debaryanum* were confirmed by the results of these greenhouse experiments.

Captan and thiram gave better control of both fungi at lower rates than zineb, provided that growth of the host plant was not retarded by low temperatures. At temperatures above 75°F, both captan and thiram were noticeably phytotoxic at rates of more than one part active chemical to 20,000 parts of soil.

Decomposition of these fungicides in the slightly acid moist soil used in these experiments was probably not significant, except perhaps for thiram. Chemical decomposition in the soil would not appear to be responsible for the lack of control often reported when these fungicides are used in the field.

Each of the four fungicides manifested striking differences in results obtained from use under different environmental conditions. In particular, control was often poor when temperatures were low (60° to 75°F).

The authors conclude that apparently many of the same factors affect performance of these fungicides, whether they are used as seed protectants and applied to the seed, or mixed with the soil. Protection obtained from each chemical was reduced under conditions unfavorable to the cotton plant, but improved markedly with temperatures that favored more rapid growth. Probably much of the inconsistency in results obtained from field application of fungicides with the covering soil at planting time could be explained by changes in the host-pathogen relationships produced by changes in environmental conditions.★★

Relative effectiveness of four fungicides mixed with non-steamed soil and tested against P. debaryanum after 0, 1, 2, and 4 weeks. (Table from Kennedy and Brinkerhoff; see footnote 1).

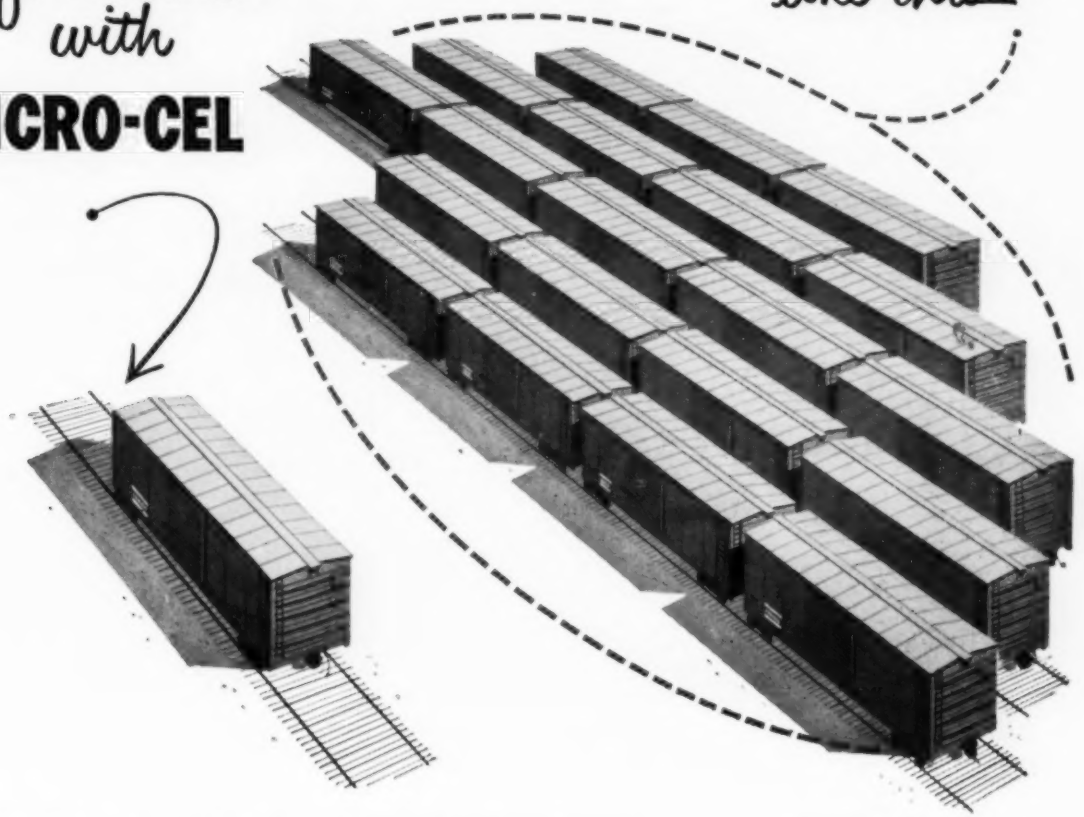
Treatment	Rate* (chemical: soil)	Surviving cotton seedlings as per cent of seed planted (time chemicals in soil before infesting and seeding; in weeks)				
		0	1	2	4	Mean
Infested soil:						
Zineb, 65%, formulation	1:20,000	5.0	8.5	1.5	8.0	5.8
Thiram, 75%, formulation	1:20,000	87.0	78.5	60.5	45.5	67.9
Captan, 50%, formulation	1.20,000	76.5	83.0	81.5	72.5	78.4
PCNB, 75%, formulation	1:20,000	31.0	30.5	7.0	16.0	21.1
No chemical	1:20,000	3.0	8.0	3.0	5.5	4.9
Non-infested soil:						
No chemical		88.5	87.5	77.0	90.5	85.9

*Rates calculated on the basis of 5 pounds per acre of each commercial formulation for 40-inch row spaces.

This shipment of 50% Heptachlor concentrate formulated with

MICRO-CEL

—can provide application quantities like this



The advantages of formulating insecticide dusts at the higher concentrations obtainable with Micro-Cel* is graphically demonstrated by the freight cars above. One car of 50% Heptachlor when let down to a 2½% poison at the point of application produces the equivalent of 20 cars of insecticide in the field. Since Micro-Cel costs no more than many other diluents, the substantial freight savings mean extra profits for you.

PROVEN WITH MANY POISONS

Micro-Cel, a new line of synthetic calcium silicates developed by Johns-Manville, has been tested and proven at such high dust and wettable powder concentrates as:

75% DDT	**70% Toxaphene**
75% Aldrin	**75% Dieldrin**
50% Aramite	**50% Chlordane**

Experiments with other poisons are under way today.

IMPROVES FLOWABILITY

Micro-Cel—"the powder that flows like a liquid"—reduces caking, increases flowability and gives more uniform coverage with dry dusts. Other important properties include large surface area, small particle size and high bulking action.

Ask your Celite engineer to help you adapt Micro-Cel to your particular requirements, or mail coupon below.

*Micro-Cel® is Johns-Manville's new absorbent-grinding aid designed specifically for the insecticide formulator.

Johns-Manville

MICRO-CEL

SYNTHETIC CALCIUM SILICATES

A PRODUCT OF THE CELITE DIVISION

Johns-Manville, Box 14, New York 16, N.Y.
In Canada: Port Credit, Ontario
Please send ☐ further information; ☐ samples of Micro-Cel. I am interested in using Micro-Cel with the following poisons:

_____

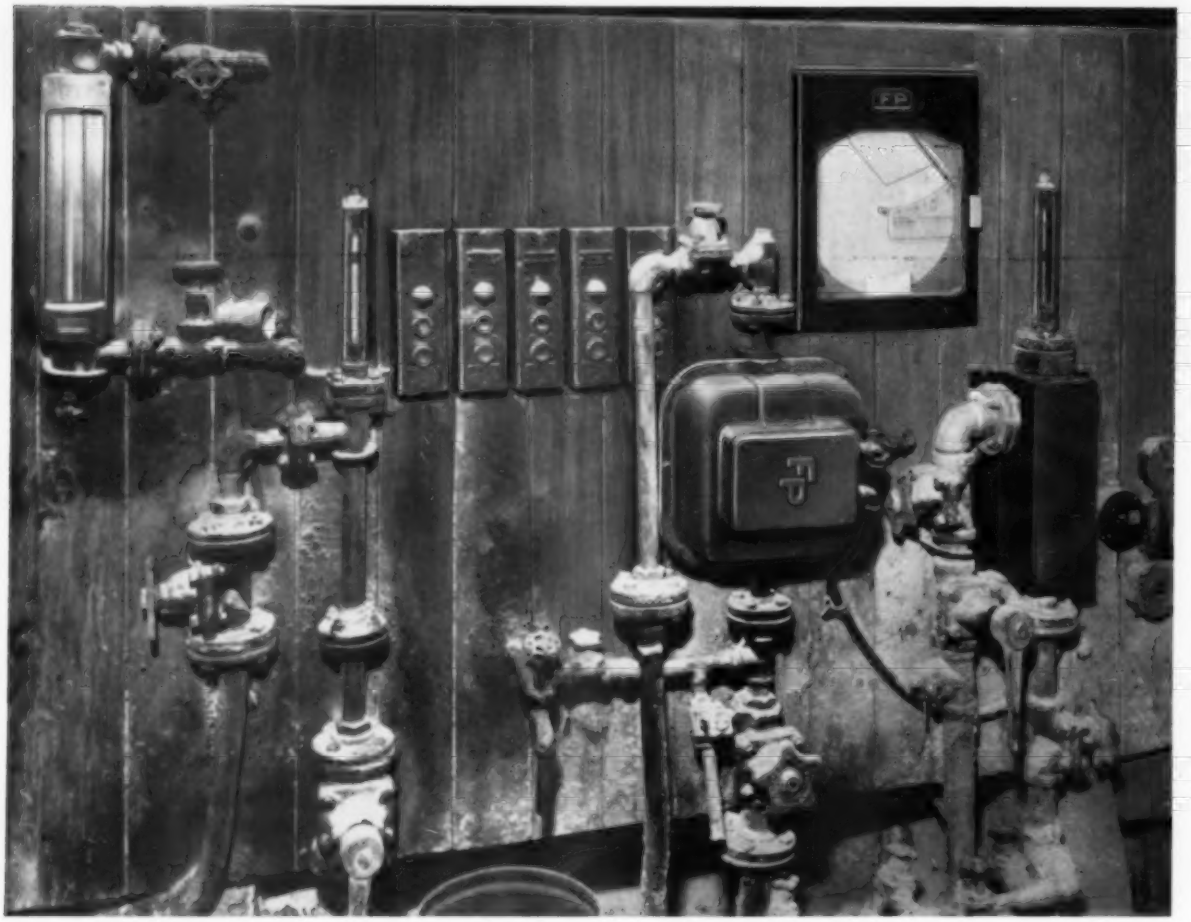
☐ Please have your local representative contact me.

Name_____ Position_____

Company_____

Address_____

City_____ Zone_____ State_____



One-inch F&P magnetic flowmeter measures wet process phosphoric acid to an accuracy of better than ±1%, independent of viscosity, density, or piping configuration at Baltimore, Maryland plant of Fertilizer Manufacturing Cooperative.

MEASURE WET-PROCESS PHOSPHORIC ACID ACCURATELY with an F&P MAGNETIC FLOWMETER

Talk about problem liquids! Wet-process phosphoric is highly corrosive, carries about 0.6% suspended solids, and its viscosity varies all over the map with temperature. Differential pressure and other types of flowmeters *can't* provide the reliable, high accuracy metering demanded in this service. NOW . . . with the introduction of the Fischer & Porter magnetic flowmeter . . . the problem is solved.

Unlike conventional meters, the corrosion-proof, erosion-proof F&P *magnetic* flowmeter has no pockets or stagnant areas where solids can collect . . . no obstructions to cause pressure drop. And rate of flow is measured to better than ±1% accuracy—independent of viscosity, density, or turbulence.

Other standard F&P features permit any F&P secondary instrument to be used with *any* F&P magnetic flowmeter. No custom matching necessary. Recorders are ideally suited for either volumetric or gravimetric record-keeping. And a simple in-case adjustment provides the same accurate direct reading gravimetric measurements despite changes in specific gravity.

Get the facts on the F&P magnetic flowmeter NOW! Contact the F&P field engineer nearest you, or write for Catalog 10D1416. Fischer & Porter Company, 1149 County Line Road, Hatboro, Pa. In Canada, write Fischer & Porter (Canada) Ltd., 2700 Jane Street, Toronto, Ontario.

FP FISCHER & PORTER COMPANY *COMPLETE PROCESS INSTRUMENTATION*

Fertilizer Views and News

By Vincent Sauchelli

Dr. Sauchelli is Chemical Technologist for National Plant Food Institute.

Some Comments On Tolerances In Statistical Quality Control

"WHEN looking for applications of statistical quality control in a chemical plant, the place to start an investigation is in the quality control laboratory. Laboratory test results are usually accepted to explain the actual variation in a process; however, from the statistical quality control point of view, we consider three other major factors which can seriously affect the test determination. These are: (1) sampling variation; (2) testing equipment variation; and (3) laboratory personnel variation."* Experience has shown that the sum of these three variations can often exceed the actual variation present in the processing and thereby vitiate the dependability of the results issued by the control laboratory. The application of statistical quality control techniques to determine the precision and accuracy of the workers in the laboratory has enabled many supervisors to raise the quality of the analysts and develop greater confidence in the results reported by the laboratory.

Analytical chemistry is becoming more and more important to engineers responsible for industrial processes everywhere as well as to sales personnel and consumers. For this reason it is obvious that management should know the quality of work done by analytical chemists and technicians. To obtain this knowledge and to raise the quality of work produced by the laboratory employees, many progressive companies have installed a quality control program on laboratory methods. By this means they can find out the precision and accuracy of the methods used, and also of the quality of the work of the control chemists.

Sampling techniques and sampling instruments may introduce variations in the chemical analysis of a fertilizer. Statistical analysis can determine whether such variations are significant. Recent studies on this phase of chemical control seem to indicate that more significant is the thoroughness with which the manufacturer mixes his fertilizer goods. Efficient mixing in the processing stage,—with perhaps a narrow range in particle size of all the raw material components,—will do more to help the product stay within the official chemical tolerance limits than refinements in sampling techniques.

Precision and Accuracy

The terms "precision" and "accuracy" have been used previously in these discussions. They have an important difference in their respective meanings as used in statistics. Precision: when two or more experimental values agree closely among themselves, but not necessarily with the true value. Accuracy: when an experimental and the true value are in close agreement. Methods of results may be precise but yet not accurate.

Tolerance

The composition of a fertilizer mixture must conform to a guaranteed analysis within close limits or tolerances. The lower limit is the tolerance permitted by the fertilizer statute; the upper limit is set by the manufacturer. It is a difficult operation to prepare a mixed fertilizer with composition that conforms with its guaranteed analysis. The nature of the raw materials—particle size, shape, density, moisture—and the unavoidable variations in sampling and analytical procedures, the biases of the personnel—make it almost impossible to sample and analyze a mixture without error and bias. To avoid penalties and maintain a reputation for quality goods, the fertilizer manufacturer seems to prefer to over-formulate his mixtures so they will analyze substantially above the lower limit set by the official regulations.

Dr. Walter A. Shewhart, father of statistical quality control, once said: "It is not only what the engineer wants but what he can get, or at least get economically, that must be taken into account in the setting of tolerance limits." Modern plant equipment can produce products of any desired degree of perfection. In practice, however, two principal limiting factors govern the degree of accuracy required, namely, (a) the intended use of the material or piece of machinery: tolerances for the quality of a phosphate destined for human food are more severe than those for a crop fertilizer; and (b) the factor of cost. All fertilizer manufacturers are ever willing to cooperate with state control officials in their work of improving sampling and analytical techniques, because they feel

(*Continued on Page* 135)

*Statement from a talk by R. V. Ward, statistician, Canadian Industries, Ltd.

KENNEDY for grinding & conveying phosphates

KENNEDY Air Swept Grinding and Pneumatic Conveying Systems are important components of this, the first, triple super-phosphate plant in Mexico. Designed and equipped by Dorr-Oliver for Guanos y Fertilizantes, its start-up is scheduled for 1960.

DORR-OLIVER

KENNEDY Ball Mills are noted for high tonnage and low cost processing of phosphate rock and other agricultural chemicals:

- Lowest maintenance cost—cannot be jammed or damaged by tramp iron or other foreign material
- No periodic shut downs for wearing part replacement
- Grinding media is replaced without interruption
- High capacity and product fineness remain constant—month after month
- Careful basic design and pressure lubrication assure high mechanical efficiency
- Reliable feed control and overall reliability provide high production with minimum manpower
- Higher capacity in single units—less space and structural steel per ton of capacity and lower initial investment.

KENNEDY AIR-FLOAT Conveyors provide trouble-free air-gravity conveying of dry materials:

- There are no moving parts—nothing to wear—nothing to maintain
- Only small volumes of low pressure air are needed—uses less power
- Operates quietly—has high capacity—requires little headroom
- The conveyed materials are completely enclosed—there is no dust
- Permits flexible design—directional changes are simple
- Can be made from corrosion resistant alloys
- Eliminates lubrication, complicated gears, belts and chains, spare parts and down time for maintenance.

Consult KENNEDY for further details. Let us show you the many advantages KENNEDY equipment can offer you.

KENNEDY VAN SAUN

MANUFACTURING & ENGINEERING CORPORATION

405 PARK AVENUE, NEW YORK 22, N.Y. • FACTORY: DANVILLE, PA.

Primary & Secondary Gyratory Crushers • Jaw Crushers • Roll Crushers • Impact Breakers • Hammer Mills • Rod & Ball Mills • Kilns • Dryers • Screens • Mechanical & Pneumatic Conveyors • Complete Crushing, Lime, Cement & Carbon Paste Plants. KENNEDY Research & Testing Service.

New Herbicides; Fire Ant Eradication; Other Federal - State Pest Eradication Programs - Discussed at Alabama PCC

AN encouraging picture of the pest control industry's fight to control or eradicate insect and disease pests was painted by speakers from six states and Washington, D. C., during the 12th annual Alabama Pest Control Conference held Feb. 24-25 on the API campus, Auburn, Ala. Attendance at the two-day meeting reached 216.

The opening day's session was highlighted by reports on research and eradication programs for the imported fire ant.

Dr. F. S. Arant, zoology-entomology department head, API Agricultural Experiment Station, said scientists from Texas to Washington, D. C., are seeking life secrets of the fire ant in studies planned to gain further detailed information about the pest. The regional project is being conducted cooperatively by eight state experiment stations and several U. S. and state agencies.

A new project is to be started soon that will involve treating two 20,000-acre tracts with an insecticide used for fire ant control and eradication. A tract of equal size will serve as a check area. Dr. Arant said the new project is designed to answer some of the questions being asked about large-scale control and eradication programs.

The joint program of the USDA and Alabama department of Agriculture for fire ant control and eradication was described by Woodrow O. Owen, supervisor in charge of the Southern Plant Pest Control Office, Montgomery. He said the revised program has been well received by both rural and urban people, and that requests continue to be submitted for block treatments and additions to already treated areas.

Three plans are offered by the program from which farmers may choose. He said these include: (1) a farmer may deposit $1 with the local committee for each acre of open land in the area, (2) he may apply the insecticide himself, with the insecticide furnished by the participating agencies, or (3) he may pay all costs for treating one-third of his open land, with the cooperating agencies handling the remainder of his acreage. Overall cost of applying insecticides under the program has been about $3 per acre, Dr. Owen reported.

Two Geigy Agricultural Chemicals herbicides were discussed by R. F. Richards of Orlando, Fla. He said Simazine is a safe chemical for pre-emergence weed control in corn, and was used successfully on large acreages in the Corn Belt in 1958. Since corn can tolerate several times the recommended rate, he explained, there is a wide margin of safety in using the material. For weed control in corn, Simazine is sprayed on the soil during planting or soon thereafter. He said woody plants generally are tolerant to the chemical, making it useful for ornamental plants.

Atrazine, a compound related to Simazine, is also effective for post-emergence control, the Geigy representative said. Atrazine can be used with good results later in the season than Simazine, Mr. Richards explained, and it penetrates deeper to give better killing of hard-to-kill perennials.

The Alabama Association for Control of Economic Pests met in conjunction with the conference. New officers elected were Dr. W. G. Eden, API Experiment Station entomologist, president; W. T. DeBusk, Penn Salt Co., Montgomery, vice-president; Dr. J. W. Rawson, Station assistant entomologist, secretary-treaurer; Walter Grimes, Extension survey entomologist, editor; and Joe Sanders, Cullman Feed and Seed Co., and W. O. Owen, USDA Plant Pest Control Office,

New Officers of the Alabama Association for Control of Economic Pests elected during the Alabama Pest Control Conference: Seated is Dr. W. G. Eden, entomologist of the API Agricultural Experiment Station, president. Left to right standing are W. T. DeBusk, Penn Salt Co., Montgomery, vice-president; Walter Grimes, Extension Service survey entomologist, editor; George P. Wilson, Wilson Air Service, Foley, director; Joe Sanders, Cullman Feed and Seed Co., new director; and B. P. Livingston, State Department of Agriculture, Montgomery, retiring president and new director.

Photo G. Stevenson

Montgomery, directors. A A C E P sponsored the two-day conference in cooperation with the API School of Agriculture and the Agricultural Experiment Station.

Good progress by the joint state-federal screwworm eradication program was reported by the USDA veterinarian in charge of the USDA part of the project. Dr. R. S. Sharman said eradication of the serious livestock pest is being accomplished by saturating the natural screwworm population with male screwworm flies made sterile by exposure to radioactive cobalt. When females mate with the sterile males, they fail to reproduce, thereby cutting down the population, he explained.

Dr. Sharman said that during 1958 about 2 billion sterile flies were dispersed over nearly 85,000 miles in Florida, Alabama, and Georgia. He said the eradication program greatly reduced the number of infestations in Florida, requiring control, and limited to less than 100 cases elsewhere in the Southeast, where thousands are normally reported every month.

Two researchers from the Florida Agricultural Experiment Station gave reports on insects and diseases of lawns and ornamentals.

Dr. S. H. Kerr, assistant entomologist, said chinch bugs and sod webworms are the most damaging insect pests of lawn in Florida, and much research is being carried out on their control. He said their work has shown that having the turf moist when applying insecticide is an aid to successful chinch bug control. If a thick turf is dry when treated, he explained, the insecticide does not penetrate the turf well, even when large amounts of water are applied when treating. Materials recommended for chinch bug control include DDT, Diazinon, and V-C 13, which can be used safely by homeowners, he said.

Turf grasses used in the South are subject to damage by nearly 100 diseases, Dr. T. E. Freeman, assistant plant pathologist, pointed out. Only a small percentage of these cause frequent damage, he said, including brown patch, dollar spot, rusts, pythium blight, helminthosporium leafspots, and gray leafspot. He explained that most of the major turf diseases occur in mild to warm weather when there is an abundance of moisture. Turf disease control is usually accomplished, he said, by using a fungicide. He advised spraying entire plantings, rather than treating spots, with complete and even distribution. Using a small amount of a wetting agent ensures complete coverage and Dr. Freeman suggested using enough water to thoroughly wet the grass. Treatments as often as every 10 to 14 days may be necessary for good control.

Spray application of pesticides must be made more simple and foolproof to eliminate human error, declared Gilbert Betulius, sales manager of Hahn, Inc., Evansville, Ind., in pointing up dealer responsibility to farmers. He said that although spray is more effective and cheaper than dust application, spraying requires more knowledge by the operator. The operator must have knowledge of various sizes and types of nozzles and a nozzle chart to show gallons put out per acre at set speed and pressure to do a good job of spraying, Mr. Betulius explained.

In emphasizing that sprayer dealers must educate the farmer on how to use and care for his sprayer, Mr. Betulius stated that large quantities of insecticides have been wasted in the Cotton Belt, because farmers were not told how to use their sprayers properly. A dealer who cannot provide this information should not be selling spray equipment, he declared.

The continued spread of the European corn borer was described by Dr. W. G. Eden during a panel discussion on "What's New." He said the insect was found in 11 new counties in Alabama in 1958, moving as far south as Montgomery County. Results of Alabama studies revealed an average corn yield reduction of 4 per cent for each borer per stalk. He said DDT, endrin, toxaphene, and heptachlor were all highly effective in reducing the number of borers.

Walter H. Grimes, Extension survey entomologist, said only four new insect pests were reported during the year. These included a seed burrowing insect (bruchid), a burrowing bug that feeds on plant roots, carnation webworm that was observed in central Alabama cotton fields in early summer, and a new species of spider mite collected from cotton.

Although fire is still the greatest potential forest enemy, L. L. Hyche, Station assistant entomologist, said it is estimated that insects cause more timber loss every year than does fire. He said increasing concern about insect damage to forests is bringing about new developments in this field.

Dr. J. A. Lyle, Station botany and plant pathology head, cited the possibility of using chemicals to help control rust diseases in grain crops. He said tests have shown that protection from rust in wheat can be obtained by spraying a mixture of nickel chloride (an eradicant) and zineb (disease protectant used on horticultural crops). Used together, he said, the materials give protection for about 10 days.

Testing and evaluating of several insecticides for control of plant and animal insect pests was discussed by Dr. W. B. Arthur, Station assistant entomologist. He said the materials include several organophosphates, chlorinated hydrocarbons, and carbamates.

In discussing insect control of legumes, Sidney B. Hays, assistant in entomology, reported that insecticidal residues are a limiting factor in using the products on legumes. Use of insecticides to control damaging legume pests is being hampered by the lack of established tolerances that make it difficult to issue recommendations, he said.

Wider use of granular and pelleted herbicides in the future was

predicted by V. S. Seacy, Station assistant agronomist. He said incorporating weed killers in the soil is a technique being studied by researchers, and looks promising for many herbicides.

Dr. Kirby L. Hayes, Station assistant entomologist, reported that some of the newer insecticides show promise for controlling external parasites of cattle. He said such materials as malathion, Korlan, and Sevin, which are relatively low in toxicity, are effectively applied from backrubbers.

A panel discussion of pest control in irrigated cotton brought out that good management of water, nitrogen, and planting rate is necessary for good control of diseases and insects.

Dr. A. L. Smith, USDA pathologist at the API Station, said boll rot, bacterial blight, and parasitic nematodes may be noticeably more serious when cotton is irrigated. He pointed out that boll rot and root-knot nematodes are the primary causes of disease loss in cotton. Boll rot, which causes 42 per cent of total disease losses in Alabama cotton, becomes more severe under irrigation, he explained. He said lodging is closely correlated with rotting, and advised using strong stemmed varieties to prevent loss. Root-knot nematodes, the second primary cause of disease loss, have rapid population build-up where high moisture levels are maintained. Since nematodes supply the means of entrance for the wilt fungus, wilt may become more severe when nematodes increase. He suggested planting varieties that are resistant to nematodes and wilt.

Work with irrigated cotton at the Thorsby Foundation Seed Stocks Farm was discussed by G. T. Sharman, Jr., superintendent. He said their experience indicates that proper insect control is a must for maximum benefits from irrigating cotton. A farmer, he added, cannot afford to gamble with insect control programs after investing in additional fertilizers and irrigation equipment.

Dr. M. E. Merkl, USDA entomologist, Leland, Miss., confirmed that good management is especially important in controlling insects in irrigated cotton. Ben Walker, Macon County farmer who is successfully growing cotton under irrigation, talked on his experiences.

Highlights of cotton insect control research in Alabama were presented by Dr. Rawson. He said good insect control was obtained when cotton was treated every 8 days. This method was as effective as treating every 4 days with the same materials, provided the amount was doubled for the 8-day interval applications. Toxaphene, Endrin, Dieldrin, Guthion, and Sevin dusts were the materials used, he explained.

Other out-of-town speakers included B. P. Livingston, Alabama State Department of Agriculture, Montgomery; Dr. R. D. Radeleff, USDA Agricultural Research Service, Kerrville, Texas; Dr. E. B. Vinson, Dexter Scientific Pest Control, Birmingham; Dr. Ralph Heal, National Pest Control Association, Elizabeth, N. J.; and Alexander Nunn, *Progressive Farmer* editor, Birmingham.

Staff members of the API School of Agricultural Experiment Station appearing as speakers were Dr. E. V. Smith, dean and director; Dr. Coyt Wilson, associate director and assistant dean; Dr. Charles F. Simmons, associate dean and assistant director; Ben T. Lanham, Jr., agricultural economics department head; Dr. E. A. Curl, associate plant pathologist; Dr. Don Davis, botanist; Dr. U. L. Diener, associate plant pathologist; Dr. G. H. Blake, associate entomologist; Dr. E. J. Cairns, nematologist, and Dr. J. M. Lawrence, associate fish culturist.★★

•

ACS Meeting April 5

Five sessions are scheduled to be held by the Division of Agricultural and Food Chemistry at the 135th national meeting of the American Chemical Society in Boston, April 5 to 10. Two of the sessions will be devoted to pesticides, two to animals and feeds, and one to food flavors.

Robert Fisher and Lawrence Rosner will present a report on the toxicology of Thuricide, a microbial insecticide. Papers prepared by T. T. White and G. G. Mc Kinley will discuss the determination of various insecticides in formulations.

The stability of malathion in small package formulations will be discussed by G. L. Mack. A report prepared by Sylvan E. Forman, Bernard L. Gilbert, Grannis S. Johnson, and Clifford A. Erickson will cover Thiodan - Carbon - 14. Other papers will discuss such topics as the response of bred ewes to differential dieldrin feeding, the effect of diet on the acute oral toxicity of arsenic trioxide, and the problems and future of agricultural and food chemistry.

Left photo:

Shown discussing latest developments in pest control are (l. to r.) John R. Cook, Cook's Pest Control, Decatur; Dr. W. G. Eden, entomologist of the API Agricultural Experiment Station, and Calton Howell, U. S. Department of Agriculture, Huntsville.

Right photo:

Some of the participants at the Alabama meeting (l. to r.) R. D. Radeleff, USDA, ARS, Kerrville, Texas; R. S. Sharman, an API graduate who now heads screwworm eradication work of the U.S. Department of Agriculture; Wade L. Allen, California Spray Chemical Co., Troy; and Dr. Coyt Wilson, associate director of the API Agricultural Experiment Station.

Photos by G. Stevenson

You can depend on Phillips *66* Service and Fertilizer Products

Phillips 66

"Good Name to Mix With"

The harassed executive in the picture above will find his job easier and more profitable . . . if he depends on all the services and products of Phillips *66*.

He'd find, in fact, that technical services and sales services are one with Phillips *66*. The main purpose being: to help mixers make more profit. Mixers can rely, too, on punctual delivery of Phillips *66* materials —Nitrogen Solutions, Anhydrous Ammonia, Ammonium Nitrate, Ammonium Sulfate, Triple Superphosphate. Got a production or sales problem? For prompt attention . . . call, write or wire.

PHILLIPS PETROLEUM COMPANY

Phillips Chemical Company, a subsidiary, Bartlesville, Oklahoma

SALES OFFICES:

Amarillo, Tex., First Nat'l Bank Bldg. • Atlanta, Ga., 1428 West Peachtree St., Station "C" P.O. Box 7313 • Bartlesville, Okla., Adams Bldg. • Chicago, Ill., 7 South Dearborn St. • Denver, Colo., 1375 Kearney St. • Des Moines, Iowa, 6th floor, Hubbell Bldg. • Houston, Tex., 6910 Fannin St. • Indianapolis, Ind., 3839 Meadows Drive • Kansas City, Mo., 201 E. Armour Blvd. • Minneapolis, Minn., 215 South 11th St. • New York, N. Y., 80 Broadway • Omaha, Neb., 3212 Dodge Street • Pasadena, Calif., 317 North Lake Ave. • Raleigh, N. C., 401 Oberlin Road • Salt Lake City, Utah, 68 South Main • Spokane, Wash., 521 East Sprague • St. Louis, Mo., 4251 Lindell Blvd. • Tampa, Fla., 3737 Neptune St. • Tulsa, Okla., 1708 Utica Square • Wichita, Kan., 501 KFH Building

Cotton Production Conference Features Reports on Quality Control and Control of Cotton Pests

PRACTICAL and research problems of growing cotton were presented at the Western Cotton Production Conference held March 3-4 at the Hotel Westward Ho, Phoenix, Ariz.

The conference, sponsored by the National Cotton Council and the Southwest Five-State Cotton Growers Association, attracted some 500 farmers, research and extension workers, and representatives of the agricultural chemical industry. The importance of quality in the industry's fight for fiber markets, as well as the urgent need to lower production costs, was stressed by numerous speakers.

"Zinc is increasing in importance as a plant food in certain areas," reported Dr. R. H. Bassett, fertility specialist at the U. C. Cotton Field Station, Shafter, Calif. In some cases, cotton plants fail to develop normally until well into the season because of a zinc deficiency. Foliar applications of a zinc compound have been effective in overcoming the deficiency.

The industry is edging closer to controlling fruiting of cotton with chemicals, but a lot of research will be needed before the technique can reach the practical stage, according to plant physiologists H. R. Carns and V. T. Walhood of California. They reported strong evidence supports the conclusion that plant hormones are a major factor in controlling fruiting.

Jim Hughes of Sunland Industries, Fresno, Calif., reported that diuron proved to be a "quite selective" means of weed control when applied to cotton seedlings six to eight inches high. Applications of diuron at 1.6 pounds per acre applied in 50 gallons of water were made in five locations. In most cases, weed control averaged 95 per cent or better.

Timing of insecticide applications is the key to economical insect control, according to T. H. Siek, ranch manager for J. G. Boswell Co., Litchfield Park, Ariz. He believes that in many cases where poor timing has resulted in either little or no control, the cause has been hurried field checks.

Resistance to Pesticides

RESEARCH work during the past few years, reported Dr. George P. Wene of the Arizona Experiment Station, Tucson, has revealed the cotton mite and the salt-marsh catepillar, army beet worm and the cabbage looper have built up resistance to certain insecticides.

The cotton mite, research revealed, has developed resistance to organic phosphate miticides. Experiments have shown that aramite, Kelthane and Tedion were more effective than increased dosages of the previously effective demeton, Dr. Wene reported.

The salt-marsh caterpillar has built up resistance to a toxaphene-DDT mixture, and the beet army worm has become resistant to DDT, the entomologist stated.

Although there have been numerous complaints about the failure of 15 per cent toxaphene plus 5 per cent DDT plus 40 per cent sulphur mixture to control lygus bugs, three large scale experiments showed the mixture still gives effective control. Dr. Wene said timing and the number of applications are important factors in lygus bug control.

Experiments have shown a dust mixture of 1.5 per cent endrin with 1.5 per cent parathion will give commercial control of the cabbage looper. For the past four or five years this pest has developed resistance to DDT, toxaphene and endrin, the entomologist said.

Reporting on the effectiveness of new insecticides in western cotton, Dr. Wene pointed out:

1. Sevin, as a 7.5 per cent dust, showed promise in controlling lygus bugs, black fleahoppers, salt-marsh caterpillar, cotton leaf perforator, thrips, and bollworms.

2. Dylox, as a spray at the rate of 1 and 1.5 pounds per acre, gave excellent control of lygus bugs, cotton leaf perforator, black fleahoppers, cabbage looper, and low populations of stink bugs.

3. Dilan, as a 5 per cent dust, gave excellent control of the leaf perforator and lygus bugs. As a spray at the rate of 0.6 pound per acre, Dilan gave a long residual control of the salt-marsh caterpillars.

4. Thimet, applied at the rate of one pound per acre to seed, gave a significant reduction in stand and yield when planting was under adverse weather conditions. Another experiment showed that when Thimet-treated seed was planted in normal weather, stand was not affected adversely.

5. Di-syston, applied at the rate of one pound per acre to seed, gave only a slight reduction in the stand count and yield when planted during adverse weather conditions.

Insect problems which the entomologist feels need more research work include timing of insecticide applications, control of various species of cotton mites, natural control measures, and systemic insecticides.

A Program to Control Pests

THE program to control cotton pests in infested areas and to keep them out of non-infested areas was detailed by L. F. Curl, assistant director of the plant pest control division, U. S. Department of Agriculture, Washington.

"It is recognized that many practical cotton producers will say the dates cannot be met," Mr. Curl said.

He compared the use of preventive measures in non-infested areas to "giving the youth of our country the Salk vaccinations, rather than waiting for the crippling polio to strike and then undertaking a long curative program which so often is not successful."

team approach to encouraging soil terials supplied by farmers or other casional shortcomings in applica-

WASHINGTON REPORT

By Donald Lerch

THE Pesticide Industry and Wildlife Conservation groups took a big step forward toward reaching a mutual understanding following this year's National Wildlife Federation Conference in New York. Taking the initiative, NAC's Executive Secretary, Lea S. Hitchner, invited some 20 top wildlife conservation officials to a luncheon at the Statler-Hilton two days following the Wildlife Federation Conference program, which was featured by a wildlife and pesticides panel.

No one necessarily expected to come up with any final answers, but both groups represented report that the luncheon served as a needed step toward establishing a common ground for pesticide makers, users, and wildlife conservationists. The potential for increased benefits for both the industry and wildlife conservation which such meetings provide is great. But no one is kidding himself that there are not some major obstacles yet to be overcome if complete understanding is to be reached.

One of the three most important resolutions passed at the Wildlife Federation conference, for example, called for action to wipe out Federal appropriations for the large-scale aerial application of "chemical insecticides, herbicides or fungicides" where hazards to wildlife resources are indicated. Moreover, the official press release following the conference highlighted charges by Dr. M. M. Hargraves, of Mayo Clinic, and Charles D. Kelly, secretary of the Alabama Wildlife Federation, attacking the use of pesticides, but only listed talks by NAC's Lea S. Hitchner, USDA's Dr. Clarence Hoffman and Lev Curl, and Fish & Wildlife's Dr. Walter Dykstra. (These talks stated the affirmative case for continuance of area-wide pest control programs.)

There is reason to hope that, as mutual understanding grows between pesticide makers and users and wildlife conservation groups, such obviously biased reporting will give way in favor of greater objectivity. In this light we applaud plans now being made to hold similar informal meetings, perhaps as often as four times a year. It seems to us that this type of activity will benefit everyone, farmers, wildlife conservationists, and the general public alike.

* * * * *

Pesticide manufacturers will want to watch the results from a variety of wildlife research projects now getting underway across the country. Bolstered by new money from Congress, the U. S. Fish & Wildlife Service is greatly expanding research on the effect of pesticides upon wildlife and ways to use pesticides with a minimum hazard to wildlife.

U. S. Fish and Wildlife had only $56,000 for such research in fiscal 1957. This was boosted to $181,000 in 1959, and the Service expects to have $280,000 for 1960. Of this total, $185,000 would be for wildlife, $62,000 for sports fisheries, and $33,000 for commercial fisheries.

Research projects now underway include more cage tests with quail to determine effects of sublethal doses of pesticides, a project to find out the longevity of toxic materials in wildlife habitat, the effect of the grasshopper control program on wildlife, effects of pesticides on fish and fish food organisms, and the effect of mosquito control programs upon commercial fisheries.

Other special projects are being undertaken to determine the effects of the imported fire ant eradication program and the Dutch elm disease control program on wildlife.

As much additional scientific knowledge as possible in the field of pesticides and wildlife is desirable. Nonetheless, pesticide manufacturers should get set for a rash of misleading interpretations and erroneous conclusions which usually follow release of scientific studies in this field.

* * * * *

The current National Plant Food Institute's fertilizer promotion is rapidly turning into one of the hottest promotions in the industry's history. Plugging two general themes—soil testing and reaching top yields and profits through proper fertilization, the promotion already is having phenomenal results.

Fertilizer consumption in 1958 jumped more than 10 percent in six test counties in Georgia where the intensified soil fertility program was carried out. Plant nutrient consumption increased by an astonishing 17.5 percent over 1957. Key to the promotion is the role that soil testing plays in persuading farmers to use the correct amount of the right kind of fertilizer and the effectiveness of the

team approach to encouraging soil testing.

Now, NPFI and the California Fertilizer Association have come out with a new promotion booklet directed not toward farmers but toward the banker—the man who lends the money for farm production purchases. The booklet hits hard the truth that scientific farming can increase farm profits in California.

Very astutely, the booklet also includes two pages urging appropriate use of pesticides to protect against the weeds, insects, and diseases which can rob farmers of profits they are striving to gain through improved fertilization.

* * * * *

Acreages treated with fertilizers and pesticides by air have climbed steadily in recent years. Nonetheless, the industry has been plagued by a shortage of firm statistics.

The Civil Aeronautics Administration (now the Federal Aviation Agency) has been making annual work inventories covering acreage treated by air. These provide some useful facts. But even the FAA inventory will not be taken this year.

To overcome this possible blackout on facts and figures, the National Aviation Trades Association is sending survey questionnaires to some 2,200 aerial applicators. Applicators are being asked to fill out and return the survey forms to NATA by April 15, and the first results are expected to become available around May 1.

Questions being asked include ones on financing, rates of application, types of crops treated, types of materials applied (fertilizer, pesticides, fertilizer-pesticide mixtures), acreages treated and times of application on the same acreage.

Of special interest to suppliers are questions on market trends and buying expectations of aerial applicators; the quantity of pesticides and fertilizers applicators intend to buy and the percentage of cases where they will merely apply materials supplied by farmers or other contractors.

This NATA aerial application survey should be one of the most valuable reviews of the aerial application business in the history of the industry. All aerial applicators are urged to fill in the survey forms promptly and return them to NATA. Results of the survey will be available to all interested groups.

* * * * *

Fertilizer and pesticide manufacturers searching for new markets might do well to take a new look at forestry. Foresters are well along on a program to raise trees as a farmer raises a crop. They expect that as tree farming becomes more intensive, more fertilizers and pesticides will be used as part of regular tree production schedules.

What makes this of special interest is that right now the U. S. Forest Service, the American Tree Farm System, and forest industries groups are promoting a vast increase in the output of sawtimber. Chief of USDA's Forest Service, Richard E. McArdle, predicts that sawtimber output will have to double by the year 2000 (just 41 years from now) if our skyrocketing population is to enjoy forest products in the abundance we have today.

Privately, leaders in forestry industries have told us that the time is ripe for more activity by fertilizer and pesticide manufacturers in this field. Foresters are anxious to learn of ways to boost tree crop yields and reduce pest losses. Insects now destroy nine times more timber than forest fires.

A factor which makes forestry an especially attractive market is the acreage now in commercial forest areas—about 485,000,000 acres compared with about 400,000,000 acres in farm crops.

* * * * *

In a little-publicized meeting, the USDA's Farm Equipment and Structures Research Advisory Committee recently took up, among other things, the question of occasional shortcomings in applications of pesticides which have led to inadequate crops.

Being engineers, the group examined the subject of pesticide application equipment and practices. Their conclusion was that "the top engineering research need in crop production is for analysis of pesticide application equipment and methods."

What is needed, the committee said, is more basic research to understand the factors affecting pesticide deposits so that equipment can be designed to provide better and more effective coverage.

Research likely to develop from this top-level recommendation will bear close watching. Improved application equipment will tend to increase pesticide effectiveness and thus favorably influence sales.★★

•

Iran Invites Bids

Bids for the supply of 23,000 metric tons of chemical fertilizer are invited by the Plan Organization of Iran. The bid includes 7,000 tons urea, 3,500 tons ammonium nitrate, 1,000 tons ammonium sulfate, 2,500 tons potassium sulfate, 8,000 tons superphosphate, and 1,000 tons of ammonium phosphate.

A copy of the bid document including specifications, terms, tender form, and sample contract form are available from BFC's Trade Development Division, U. S. Department of Commerce, Washington 25, D. C. Bids must be in not later than April 21.

•

Europe To Finance Plants

The Mexican nationalized petroleum industry (Pemex) plans to use a $20 million credit granted by five European banks to increase fertilizer and anhydrous ammonia production. Three big fertilizer plants are scheduled to be established within the next two years at Manitatlan, Salamanca, and La Laguna.

Mexico will buy equipment for the projected plants in France, Germany, Holland and Belgium.

MARKET REPORT

Fertilizer Sales To Hold

The fertilizer industry expects the current agricultural year to be at least as good as the year ending June 30, 1958. Indications are that 1957-58 demand for total plant food was about the same as in the preceding year, although the continuing trend toward higher-analysis materials probably resulted in a slight decline in gross weight of fertilizers used.

Production of anhydrous ammonia in 1958 ran only about three per cent ahead of 1957, but urea output was up about 10 per cent.

Copper Sulfate Threatened

Future exports of copper sulfate may be seriously affected by experiments now being conducted on banana plantations, according to the U. S. Department of Commerce. A fungicidal oil, supplied by three oil companies, is being tested for control of Sigatoka, a fungus disease, in Ecuador, Jamaica, Panama, Guatemala, Columbia, and Honduras.

The agricultural oil has a decided price advantage, and if the results of the experiment are satisfactory from the standpoint of its effect on the quality of the fruit and other factors, exports of copper sulfate from the U. S. could be reduced considerably. Of the 70,680 short tons of copper sulfate produced in 1957, 33,644 tons were exported. Latin America received more than 80 per cent of this total.

Potash Deliveries Down

Deliveries of potash for agricultural purposes in the United States, Canada, Cuba, Puerto Rico, and Hawaii by the eight principal American producers and also the importers totaled 3,805,057 tons of salt containing an equivalent of 2,229,724 tons K_2O during 1958, according to the American Potash Institute. This was an increase of 10 per cent over the same period in 1957. Deliveries of potash for non-agricultural purposes were eight percent under last year.

In the Spotlight this Month

- **Weed Killers . . .** Synthesized originally for trials as a nematocide, Endothal, is gaining prominence as a herbicide, particularly suited for use on beets and spinach. Both these crops tolerate doses of endothal which will kill weeds in pre-emergence applications and, in some instances, in post-emergent treatments. Page 38.

- **Urea in Nitrogen Solutions . . .** Addition of urea to ammonium-nitrate and ammonia in nitrogen solutions reduces the saturation or salting out temperature of the solution. Page 50.

- **Granular Pesticides . . .** In formulation of granular pesticides, selection of carrier, solvent, conditioning agent, deactivator, and stabilizer are important factors. Tendency toward caking is minimized by following correct formulating procedure, and using a satisfactory carrier, freshly prepared and without excess free moisture. Page 30.

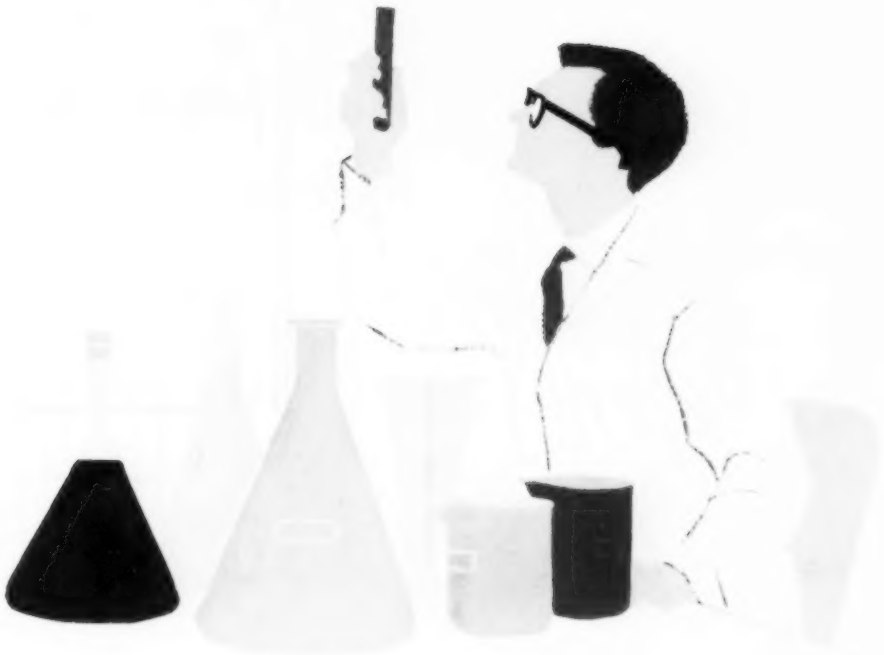
- **Noxious Insects and Weeds . . .** In tests for control of tobacco hornworm, spores of bacterium have in some cases proved as effective as endrin, the most dependable insecticide. However, the spores do not control the budworm and other insect pests, for which insecticides must still be used; and it is impractical for a grower to apply a biological control agent for one pest and an insecticide for another, if he has an insecticide that will control both. Page 33.

- **Fume Formation in Fertilizer Manufacture . . .** From an economic and operational standpoint, the effort to improve fume conditions should be focussed on design of the furnace. A combustion chamber and burner system which produce as little luminous radiant heat as possible in both the flame and refractories is the basic answer Page 44.

- **Granulated Fertilizers . . .** The basic economics of formulating mixed fertilizers with nitrogen solutions in combination with anhydrous ammonia favor use of the nitrogen solution which contains the highest fixed-to-free nitrogen ratio. Page 47.

INTERNATIONAL'S
FULL ORBIT
SERVICE

Setting New Standards
of Quality Control



CHECK OUT COUNTER THAT KEEPS TAB ON

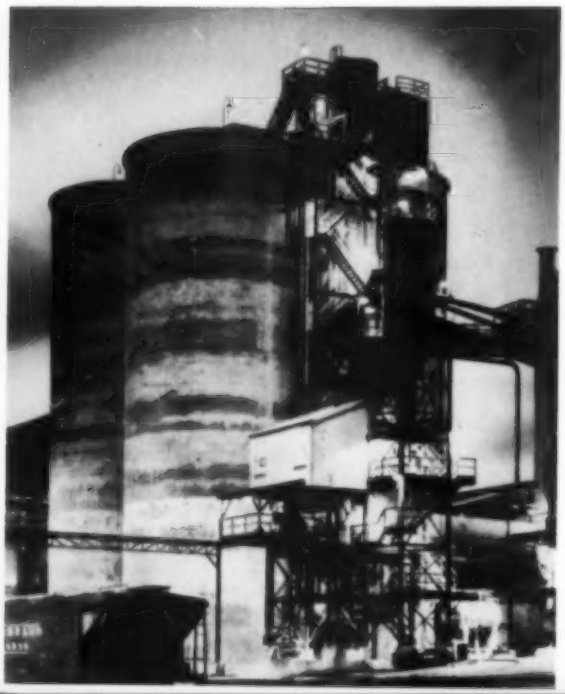
TRIPLE SUPER

MINERALS International CHEMICALS

Quality

Quality of product carries a lot of weight with manufacturers who buy fertilizer materials. That's why...

International quality from



Over 40 separate tests, more than 400 chemical analyses daily help produce a uniformly superior Triple Superphosphate that's conditioned for trouble-free shipping

Product quality rates high with users who stay with International's Triple Superphosphate. The right combination of chemical and physical characteristics means a uniform product that holds caking problems during shipping and storing to a

STORAGE — Triple superphosphate (granular, run-of-pile, coarse) is stored and cured in a 90,000 ton warehouse for a minimum of 5 weeks to assure desirable chemical and handling characteristics . . . maximum plant food availability.

PLANT FOOD MANUFACTURER — Final control check . . . 6 quality tests made as triple superphosphate is loaded for shipment.

checks out Triple Super Bonnie right to your plant

minimum. Easier handling and superior ammoniating qualities result.

Much of the credit goes to the technical task force that guards the quality of International's Triple Super. For testing is a round-the-clock operation at Bonnie, Florida. Testing follows every phase of processing . . . starting at the mine and climaxing in a rigid final checkout that each shipment must pass before it can load and go.

After International's Triple Super has been processed into three grades — granular, run-of-pile, coarse — it is stored and cured in a 90,000 ton warehouse for a minimum of 5 weeks. This produces the finest chemical and handling characteristics . . . maximum plant food availability. Then comes the final checkout: six quality control tests made *as triple is loaded for shipment!*

Painstaking? You bet it is! And worth every bit of the extra effort in terms of your confidence that every shipment of International's Triple Super is as high in quality as today's finest processing can make it.

With triple ready to roll, International service takes over. There's shipping — by rail, barge, ship — whichever method keeps your costs lowest. You benefit from service that's tailor-made for your own plant — delivery by river barge . . . on-site storage at key transportation centers . . . rolling warehouse shipments. That's why International's services can't be matched by any other supplier.

And there's International's staff of experts, ready to help on formulation and equipment problems . . . designing plant layouts . . . streamlining materials handling — *at no cost to you!*

To sum it up — you profit when you depend on International's Triple Super.

COARSE — International's coarse-textured Triple gives you the same excellent ammoniation batch after batch . . . promotes desirable agglomeration.

GRANULAR—International's granular Triple is non-crumbling, free-flowing, makes granulation easier. Sponge-like structure of granules facilitates ammoniation.

RUN-OF-PILE — International's fine-textured Triple provides uniform particle size, even density and proper moisture level that lets you ammoniate at higher rates, temperatures.

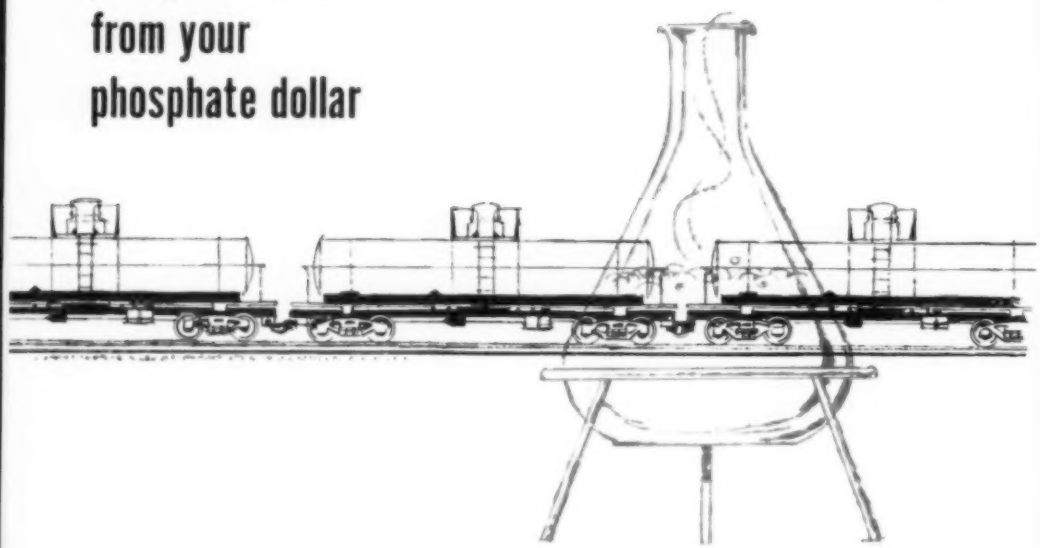
TRIPLE SUPERPHOSPHATE

Available P_2O_5 (min. guarantee) — 46.0%

Particle size:

	R.O.P.	GRANULAR	COARSE
—6 mesh	98-100%	97% min.	97%
—65 mesh	22-34%	0.5% max.	3%

International's quality "check-out" helps you get full value from your phosphate dollar



A complete line of triple superphosphates and phosphoric acid solves formulation problems

Now you can make International your dependable single source of all high-analysis phosphate ingredients. Benefit from International's three grades of top-quality triple superphosphate plus high purity 53%-55% phosphoric acid. Get all the quality advantages International's processing adds to your product. Be sure with International.

INTERNATIONAL'S FULL ORBIT SERVICES

Minerals International Chemicals

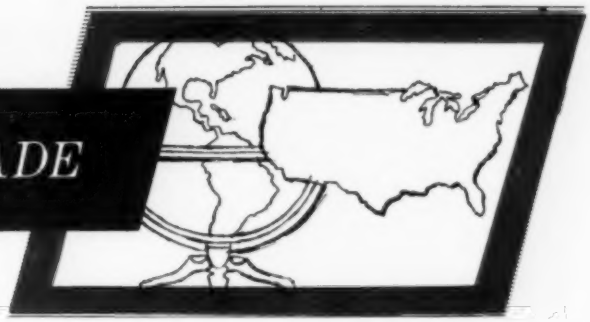
Creators of Living Minerals

SPECIAL PRODUCTS DEPT., PHOSPHATE DIVISION

INTERNATIONAL MINERALS & CHEMICAL CORPORATION

Administrative Center: Skokie, Illinois

NEWS about the TRADE



Catir To Buffalo Mill

Philip S. Catir has been named director of feed purchasing at the Buffalo, N. Y., mill of the Eastern States

Catir

Phelps

Farmers' Exchange. He had been manager of the agricultural chemicals purchasing and production department at Eastern States' headquarters in West Springfield, Mass.

In other moves announced by the company, Cleon Phelps, manager of the agricultural chemicals blending and distribution plant was named manager of plant operations for the agricultural chemicals and farm supply departments for both the West Concord and the Spring Garden, Pa., plants. Perry H. Wetzel has been named manager of the agricultural chemicals purchasing department. He had been assistant manager.

•

Stable Methyl Parathion

The Monsanto Chemical Co., St. Louis, Mo., has announced the development of a stabilized methyl parathion for dust formulations which effectively resists decomposition during extended storage at high temperatures.

•

USDA Clears Sevin For Use

The United States Department of Agriculture has just O.K.'d the use of the new Crag "Sevin" insecticide on apples, peaches, beans and potatoes with the granting of label acceptance.

Sevin, which is a carbamate, has proved in tests to be effective for the control of insects which have developed resistance to insecticides previously used. Sevin has been found to be effective on the following fruit insects: codling moth, apple maggot, red-banded leaf roller, apple aphids, plum curculio, fruit tree leaf roller, periodical cicada, oriental fruit moth, peach twig borer and cat-facing insects; and also on the following vegetable insects: Mexican bean beetle, Colorado potato beetle, leafhoppers, flea bettles, Lygus bugs and stink bugs.

•

Thompson Names Res. Director

Dr. Louis P. Gerber has just been named Research Director of Thompson Chemicals Corporation, St. Louis and Los Angeles, manufacturers of agricultural and industrial chemicals. Dr. Gerber will conduct a program of research designed to expand Thompson Chemicals' product line.

He was formerly with Schenley Laboratories and later worked with Arden Farms and California Corporation for Biochemical Research.

•

US, Canadian Groups To Meet

The ninth annual meeting of the Entomological Society of Canada and the ninety-sixth annual meeting of the Entomological Society of Ontario will be held jointly with the annual meeting of the Entomological Society of America at Detroit, Mich., Nov. 30 to Dec. 3, 1959.

•

Stauffer Names Two

John W. Kennedy has been named assistant sales manager, Industrial Chemicals Division, North Portland, Oregon, by the Stauffer Chemical Co., New York.

At the same time, A. Preston Young was named to a like position at the company's Los Angeles office. Both men formerly were Stauffer field representatives.

Propose Licensing of Pesticide Salesmen in California

New legislation which would require the licensing of pesticide salesmen is under consideration in California. A meeting was to be held in San Francisco, March 31, at U.S.D.A. offices, with Dr. Allen Lemmon presiding, to discuss the proposed legislation.

It is reported that an annual registration fee of $10 is being considered. Apart from the financial consideration involved, many in the pesticide industry are concerned over the authority that state officials would have to grant or withdraw licenses.

Similar legislation had been proposed earlier in both Idaho and Washington, but proposed control measures were later withdrawn.

Among the associations that were represented at the March 31 hearing were the Western Agricultural Chemicals Association in the person of Charles Barnard, executive secretary, and Lea S. Hitchner for the National Agricultural Chemicals Association.

Among the supporters of adoption of such a licensing law is the California Agricultural Aircraft Association. Custom applicators, who are themselves subject to license by the state, feel that they are being unfairly discriminated against. Pesticide salesmen, they point out, operate without any necessity of licensing, and have been making recommendations on pesticide use to growers and others.

Ninth Botanical Congress

The Ninth International Botanical Congress will be held in Montreal, Canada, Aug. 19 to 29.

Held every five years, the congresses are attended by delegates from all over the world. Commercial firms will be given an opportunity to sponsor exhibits at the congress.

•

Calif. Agricultural Forum

The Central California Agricultural Forum was held March 24 in Fresno and featured a talk on soil fumigation for the control of nematodes by Dr. L. C. Glover, Shell Chemical Corp., San Francisco.

The application of soil fumigants was discussed by Al Nielsen of the Joaquin Agricultural and Engineering Co., Delano. Dr. John W. Griggs, Bioferm Corp., San Francisco, outlined the development and testing of microbial insecticides. A panel on weeds closed the meeting.

•

New Canadian Plant

The Consolidated Mining and Smelting Co. of Canada Ltd. plans to build a urea plant at Calgary, Alberta, that will have an annual capacity in excess of 36,000 tons.

The new plant will be operated in conjunction with the company's ammonia and chemical fertilizer plants in Calgary.

•

Issue Applicator Patent

U.S. Patent No. 2,876,932 has been issued for the "Little Squirt Spot Fumigant Applicator," manufactured by Ferguson Fumigants, Inc., Ferguson, Mo.

The applicators are a part of a system of spot fumigation introduced to the cereal milling industry in recent years.

•

Offer Bactericide-Fungicide

The Nationwide Chemical Co., Fort Myers, Fla., is offering a new plant bactericide-fungicide, Nabac 25.

The product has been sold to growers in the Fort Myers area on a trial basis for the past few months and is said to control bacterial diseases on peppers and tomatoes. Nabac 25 also can be used for both downy and powdery mildew and damping off of many crops.

•

Tour West Virginia Plant

A group of midwestern businessmen were guests of the West Virginia Pulp and Paper Company recently for a tour of its Charleston, S. C. plant. Stewart Draudt (left), Westvaco Chicago district sales representative, explains the Clupak Kraft Paper Machine control panel to G. B. Dunbar Jr. (right), Smith, Douglas Co., Streator, Ill. In addition to the stretchable paper machine, the group inspected a new design laboratory where specific packaging problems are being studied.

•

Agrico Buys Plant Site

The American Agricultural Chemical Co., New York, has purchased a 64-acre site at Sleepy Eye, Minnesota, for the construction of a fertilizer plant. No date has been set for the start of construction.

•

TVA Offers Phosphoric

The Tennessee Valley Authority has made an offer to supply phosphoric acid to plant food manufacturers who want to experiment with it in producing liquid fertilizer by a new TVA process.

TVA points out that the number of plants producing liquid fertilizers today has more than tripled since 1955. TVA engineers have found that the addition of their new superphosphoric acid is a promising method of overcoming the formation of solid impurities often encountered when using wet-process acid.

North Central ESA Meets

The 14th annual conference of the North Central Branch of the Entomological Society of America was held in Columbus, Ohio, March 25 to 27.

Among the speakers and their topics were: D. W. Hamilton, Apple losses due to insect attack; C. R. Cutright, Results of field tests with Sevin against apple insects; M. L. Cleveland, Soil injections with systemics for control of orchard mites; and J. M. Ferris, A preliminary survey of plant parasitic nematodes in Indiana.

Some other speakers were: E. D. Fisher, The use of repellents in dairy cattle sprays; O. Newlin, Evaluation of insecticidal seed treatments on corn; and R. E. Munson and D. C. Peters, Timing of European corn borer control in Missouri.

The meeting was concluded with informal discussion sessions on insects of forage crops, truck crops, and fruit crops.

•

Test Dri-Die In Nurseries

Preparations for testing Dri-Die Horticultural Dust 91 are being made by the Davison Chemical Division of W. R. Grace & Co., Baltimore, Md.

Experimental label registration has been granted for tests in greenhouses.

•

Plan Tampa Terminal

The Pan American Sulphur Co., Houston, Texas, plans to construct a dry bulk and liquid sulfur storage facility at Tampa, Fla.

Total storage capacity of the proposed facility will approximate 65,000 gross tons.

•

To Offer Granular Thimet

The American Cyanamid Co., New York, will offer its systemic insecticide Thimet in granular form to potato growers in Ohio, Michigan, and Wisconsin this month.

Thimet is being recommended in the three states for the control of aphids, leafhoppers, and flea beetles.

FULL ORBIT SALES TRAINING MEETINGS A SMASHING SUCCESS!

Full Orbit blazes another new trail in customer service — this time in the interest of upgrading the merchandising practices of the industry. In response to customer requests, 10 sales training meetings were held in key cities around this country and Canada with the sole objective of helping fertilizer manufacturers sell more merchandise profitably. Theory, platitude and generalities were excluded. These were intensive two day sessions devoted to practical, down-to-earth treatment of specific problems chosen by the audience in advance. Approximately 400 representatives of 300 manufacturers were present with middle and top management represented as well as salesmen.

We are sorry if the timing did not permit you to be among them. However, ask our representative to tell you about the many other Full Orbit services — all designed to help you sell more fertilizer profitably.

Here's what fertilizer manufacturers are saying:

William Lust, Tyler Fertilizer Company, Tyler, Texas: "This was a very fruitful meeting for me. It covered specific points and I wish others in our company could have been here."

Forest Viator, Louisiana Agricultural Supply Company, Baton Rouge, La.: "Our time here was well spent, and not wasted. It covered fundamentals, not flashy promotion. It was the best meeting, from a standpoint of being organized, that I can remember attending."

Archie T. Edwards, Red Star Fertilizer, Sulphur Springs, Texas: "Our group was pleasantly surprised by the number of good ideas and good principles covered. We're going to make good use of them and I hope others get a chance to attend."

Stanley Hackett, President, Dixie Fertilizer Company, Shreveport: "This type of meeting should be expanded. I know it's primarily for salesmen, but I got a lot of good out of it as a company president, and hope it's put on again in this area so more people can attend."

Joseph Stobaugh, Southern Cotton Oil Company, Little Rock, Ark.: "This meeting has been rewarding to our group. It reminded us of some places we may have slipped in our selling, and it shows the need of stressing product quality."

T. H. Golson, Wesson Oil & Snowdrift Company, New Orleans: "This has been one of the best meetings I have attended from the standpoint of bringing back some of the things we might have known but have quit using. It covered fundamentals and will be helpful to industry because it gives them something to think about besides price."

R. G. Dozier, Jr., Dawson Cotton Oil Company, Dawson, Ga.: "I am thankful for this very educational and constructive meeting. I got a lot out of it."

Les Engler, Commonwealth Fertilizer Company, Russellville, Ky.: "It was a very profitable meeting and was handled in a stimulating manner."

Producers of Living Minerals

MINERALS International CHEMICALS

20-59

INTERNATIONAL MINERALS & CHEMICAL CORPORATION

Administrative Center — Skokie, Illinois

Brunn Joins Hopkins

Lynn Brunn, who recently left his position as assistant industry manager for insecticides and oil products with Atlas Powder Company, Wilmington, has joined Hopkins Agricultural Chemical Company, Madison, Wisconsin, in an executive position.

•

Spencer Names McMillan

E. J. McMillan has been named to represent the Spencer Chemical Co., Kansas City, Mo., in an area comprised of Colorado, New Mexico, and West Texas. Mr. McMillan has been with Spencer since 1942.

•

Market Development Manager

Robert C. Hickerson has been named chemical market development manager of the Tennessee Products & Chemical Corp., Nashville. He joined the company in 1950 and had been chemical products development manager.

•

To Buy U. S. Equipment

Societe Egyptienne d'Engrais et d'Industries Chimiques, Cairo, Egypt, plans to expand its operation with equipment to be purchased in the United States under a $5 million credit authorized by the Export-Import Bank of Washington.

The Egyptian fertilizer company will enlarge its ammonia production facilities by 50 per cent.

•

Tampa Sulfur Terminal

Plans to establish a molten sulfur terminal at Tampa, Fla., employing for the first time an ocean-going vessel especially designed for the shipment of sulfur in liquid form, have been announced by the Texas Gulf Sulphur Co. and the DeBardeleben Marine Corp. of New Orleans, a large water transportation organization.

Beginning in August, molten sulfur will be shipped to Tampa from Texas Gulf's loading terminal at Beaumont, Texas, in a Liberty vessel that is being equipped by DeBardeleben with steam-heated tanks capable of holding 7,500 tons of molten surfur.

At Tampa, the sulfur will be stored in steam-heated tanks and held for distribution by railway tank cars or tank trucks to users in the surrounding area.

•

James Gorman Retires

James Gorman, manager of nitrogen products for the American Cyanamid Co.'s Agricultural Division since 1944, is retiring after 32 years with the company. C. Paul Schaefer, assistant nitrogen products manager, has been named to succeed him.

•

American Ag. Stock Split

Directors of the American Agricultural Chemical Co., New York, proposed a three-for-one split of the company's common stock.

•

Nitrogen Div. Renames Product

Nitrogen Division, Allied Chemical Corp., has changed the color and the name of its "Uran" nitrogen solution. The product will in the future be called Golden Uran in line with the change in color from clear to golden. Except for the new color, no other changes have been made in the product itself.

Chairman Of Chemagro Board

George W. Hill Jr. has been elected chairman of the board of the Chemagro Corp., Kansas City, Mo. He had been president of the company.

Replacing Mr. Hill as president is Herbert F. Tomasek, formerly vice president.

•

Witco, Emulsol Merger

The Witco Chemical Co., New York, has announced the merger of Emulsol Chemical Corp., Chicago —a Witco subsidiary—with Witco's Organic Chemicals Division.

The Emulsol sales staff has been absorbed into the Witco organization and the Emulsol laboratories have been consolidated with Witco's research and development laboratory in Chicago.

•

Bird Joins Wise Co.

Benjamin Bird has joined Robert S. Wise Co., Wichita, Kans., as vice president and general manager. He had been manager of the Wichita Chamber of Commerce's agricultural department.

The Wise company manufactures and formulates agricultural chemicals and spraying equipment.

Industry Representative Opposes Enactment of S 11

Appearing before the Antitrust and Monopoly Subcommittee of the Senate Committee on the Judiciary in Washington, March 19, Robert L. Ackerly, of the law firm of Cummings, Sellers, Reeves & Conner, general counsel for the National Plant Food Institute and the National Agricultural Chemicals Association, spoke in opposition to the enactment of S 11.

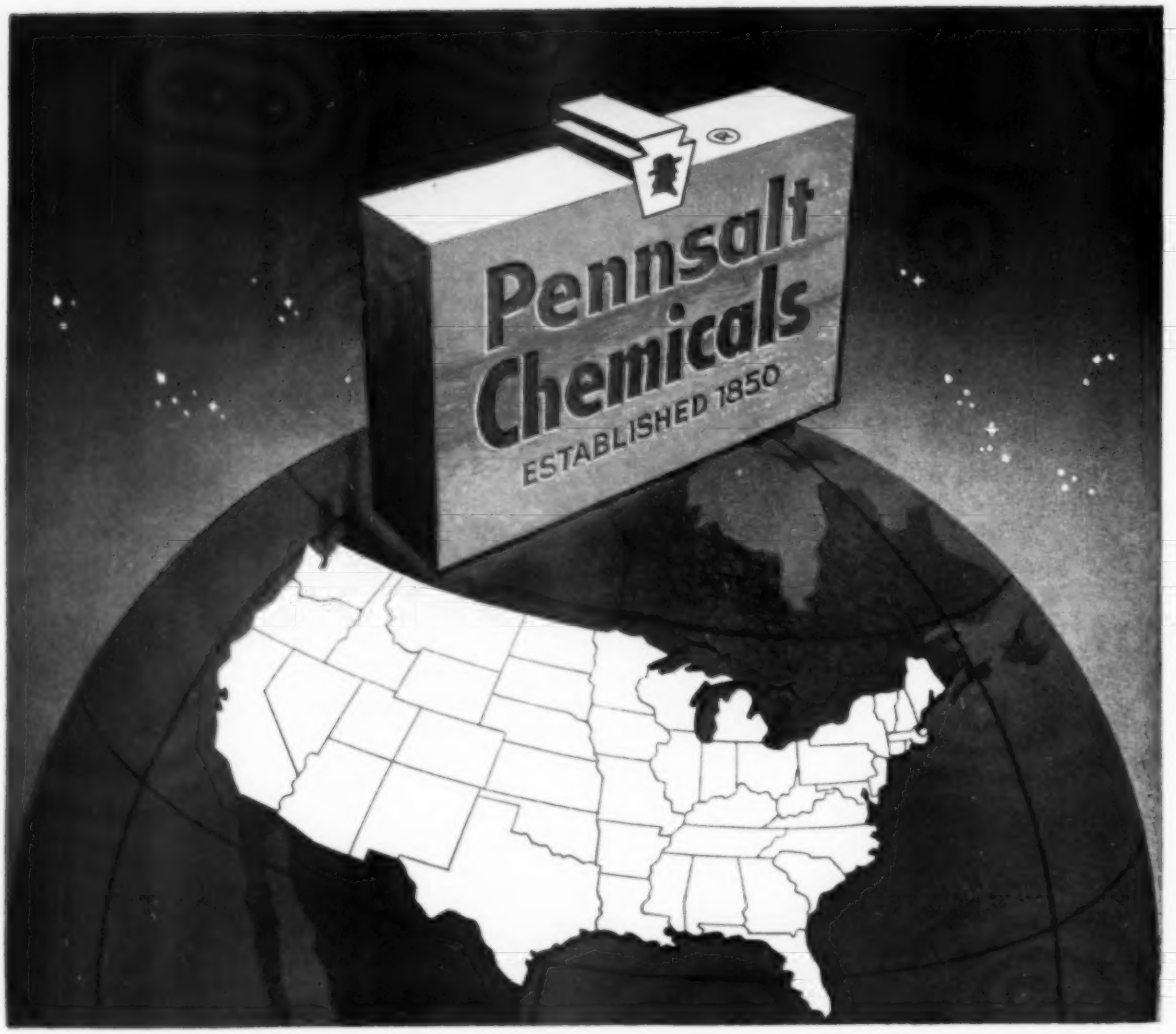
Sponsored by Sen. Estes Kefauver of Tennessee and Rep. Wright Patman of Texas, the bill, it is feared by chemical manufacturers, would make it next to impossible for sellers to protect themselves against price-cutting and customer raiding tactics of their competitors.

Mr. Ackerly emphasized two points of opposition:

He said that the bill may jeopardize many lawful marketing practices which are well established and have been followed for many years and would interject an area of vagueness into the already vague and uncertain field of antitrust enforcement.

Also, he said, there are at this time no practices in the distribution of fertilizers and pesticides which would warrant passage of the proposed legislation.

Mr. Ackerly pointed out that there are numerous instances in which fertilizer manufacturers or materials producers are called upon to meet a competitor's lower price in one or more grades of fertilizers, either within a restricted marketing area or to a limited number of dealers.



PENCO®

AGRICULTURAL CHEMICALS

relied upon from Coast-to-Coast

Known for

Quality • Service • Dependability

PENNSALT OF WASHINGTON DIVISION

PENNSALT CHEMICALS CORPORATION

TACOMA 1, WASHINGTON

OFFICES AND PLANTS:

Aurora, Ill. Bryan, Tex. Los Angeles & Menlo Park, Calif.
Montgomery, Ala. Portland, Ore. Wenatchee & Yakima, Wash.

Pennsalt®
Chemicals
ESTABLISHED 1850

Plan Gypsy Moth Spray

The U.S. Department of Agriculture and New York State are planning a limited campaign against the gypsy moth in that state this year.

The spraying is expected to be confined to a small area on the western periphery of the infested zone in New York in an effort to push the gypsy moth back across the Catskill mountains.

Details of the Federal-State program are still being worked out but New York State officials are said to be testing Sevin for use instead of DDT in some areas, such as valleys where dairying is the main activity.

Little spraying was accomplished last year because of the court suit that followed the extensive aerial and ground spraying of 1957. Last June, the Federal court in Brooklyn held that the government had a legal right to spray. This decision has been appealed to the Circuit Court of Appeals.

•

Spencer Shifts Two

The Spencer Chemical Co., Kansas City, has shifted two members of its Agricultural Chemicals Division.

Proctor Gull, formerly manager of agronomy and market development, has moved to the company's Research and Development Division to become Manager of New Agricultural Product Development.

R. L. Balser, formerly a senior agronomist for Spencer, has become Manager of Sales Promotion, Agricultural Chemicals.

•

Granulated Insecticides

In the March issue of *Agricultural Chemicals* we were pleased to publish a very fine report on "Progress in Granulated Insecticides," which was prepared by Ernest L. Gooden, USDA, ARS, Beltsville, Md. (pages 30-31).

Through a mix-up in by lines, the name of E. D. Burgess appeared as author of this article.

We very much regret the error.

Two To IMC Sales

Donald Lewis has accepted a position as supervisor of sales in Vermont and New Hampshire for the International Minerals & Chemical Corp., Skokie, Ill. At the same time, Rome Schwagel, was named supervisor of sales in a six-state area for IMC.

Mr. Schwagel's area includes Maryland, Delaware, Virginia, West Virginia, North Carolina, and South Carolina. He had been vice president of Eastern States Soil Builders, Inc.

Mr. Lewis operates a 350-acre farm near Pomfret, Vermont.

•

Two Join Bradley & Baker

James E. Corgill and H. Parker Rea have joined the staff of the Atlanta, Ga., sales office of the Bradley & Baker Corp.

Mr. Corgill covers the northern half of Alabama and Mississippi and counties 'n western Florida and southern Louisiana.

•

Aramite Label Ruling

Pesticide people who have products containing Aramite have been told by the USDA to revise their labeling so that the recently-established zero tolerance for the material will be noted on package.

Named Chief Engineer

James F. Porter has been named chief engineer for the Chase Bag Co., New York. He had been manager of the firm's manufacturing plant in Toledo, Ohio.

James E. Town Jr. has replaced Mr. Porter at Toledo.

•

Elect Two Vice Presidents

The Texas Gulf Sulphur Co., New York, has announced that H. S. Caven and A. N. Myers have been elected vice presidents of the company.

•

To Change Company Name

The Board of Directors of The Texas Co., New York, has voted to change the name of the company to Texaco Inc., subject to ratification by the stockholders at an annual meeting, April 22.

•

Omar Sanders Dies

Omar Sanders, 67, a consultant for the National Potash Co., a subsidiary of the Freeport Sulphur Co. and the Consolidation Coal Co., died March 29th at his winter residence in Sarasota, Fla. He had been in the fertilizer business for forty years.

TVA Farm Demonstration Brings Increased Yields

Increased yields through the use of chemical fertilizers were reported by farmers attending a TVA farm test demonstration program in Las Animas, Colo., March 6.

The farmers selected for the test program in four southeast Colorado counties reported that the average increased yields amounted to 1.5 tons for sugar beets, 16 bushels for sorghums, 12 bushels for corn, 2.7 tons for corn silage, 14.8 sacks for potatoes, 3.2 sacks of onions, 13 bushels for wheat, 9 bushels for oats and 625 pounds for popcorn.

The ratio of increased yields to cost of fertilizers is to be worked out as soon as all the reports on the program have been completed.

Participating in the discussions were Gene Allred and C. A. Flowers of Knoxville, Tenn., TVA representatives; Rodney T. Tucker, extension agronomist, and Bill Stewart, assistant agronomist, of the extension service of the Colorado State University, Ft. Collins, Colorado.

It was pointed out that the fertilizer demonstration program, which will extend over a five-year period, is for experimental testing only. The TVA is distributing the fertilizers through local dealers in the Southeast Colorado test area. The fertilizer ratios used last year for the demonstration were 21-53-0, 30-10-0, and 0-54-0 and ammonium nitrate.

For the future of the program the farmers were urged to test soils earlier, keep better records and have accurate harvesting data.

N. P. F. I. NEWS

Soil Fertility Is Theme
Of Washington Meetings.
Soil Booklet For Banks

In the West

California Soils Booklet

The National Plant Food Institute and the California Fertilizer Association, with the assistance of the University of California, have published a 20-page booklet for banks and other lending agencies entitled, "More Profits from Fertile Soils in California."

The booklet emphasizes that scientific farming is a "must" for the modern farmer. Illustrated examples are shown of what fertilizer can mean in terms of farm profits and the booklet emphasizes companion production practices needed to get the most from fertilizer.

On the average, the booklet states, California farmers use only 50 per cent of the fertilizer recommended for top profit.

Fertilizer Dealers' Day

Better use of more fertilizer was the theme of a Central Washington fertilizer dealers' day held in Yakima last month. Emil Nelson of the Irrigation Experiment Station at Prosser, Wash., presented facts and figures on fertilizer recommendations for irrigated crops and said that it might take a long time to run low on available potash if only 50 pounds of actual nitrogen is used per acre on corn. When we start using 200 pounds of nitrogen and 100 pounds of phosphate, however, to get top yields, we really start pulling heavily on soil potash, he said.

F. Todd Tremblay presented some of the results of a Washington Five-Acre Corn Contest and said the contest has done a good deal to stimulate interest in higher yields per acre and the use of good management to grow more corn at less cost per bushel. A soil testing panel moderated by Dr. B. B. Bertramson of Washington State was of the opinion that fertilizer dealers would be wise to join forces with county agents to push soil testing programs in all areas.

Forest Fertilizer Panel

A panel reporting on forest fertilizer use was a feature of the 15th annual meeting of the Western Washington Farm Forestry Association.

The panel was made up of Dr. S. P. Gessel, associate professor of the forestry department of the U. of Washington; Dr. Ken Turnbull, U. of Washington; Dr. C. H. Fowles, U. of British Columbia, and Dr. Darrel Turner, Western Washington Experiment Station. F. Todd Tremblay, regional director of the NPFI, moderated.

Montana Plant Food Meeting

Increased emphasis will be placed on soil testing in Montana, according to Bernard L. Brown, Montana State College extension soils specialist, who spoke at a recent meeting of the Montana Plant Food Association at Great Falls. Mr. Brown said that standard soil tests to be run include pH, conductivity, phosphate, lime, texture, and potash, if requested.

John Reuss, assistant in soils discussed native hay fertility experiments and said substantial yield increases were obtained by use of fertilizer at 11 of 12 test sites. He said that stands containing a large percentage of grass responded best to nitrogen applications, and grass-legume stands, where the soil phosphate was low, responded best to nitrogen and phosphate used together. The NPFI provided financial assistance.

F. Todd Tremblay, regional director of the NPFI, discussed the position of the fertilizer dealer in modern day agriculture and said that it is up to the fertilizer dealer to keep up with modern fertilizer trends in distribution and know-how. The day-long session was moderated by Dr. J. C. Hide, professor of soils at Montana State. Newly elected officers for the Montana Plant Food Association included George Mason, president; Thomas Selstad, vice president, and Warren Stensland, sec.-treas.

NEW MEXICO AGRICULTURAL CHEMICALS CONF. SPEAKERS

Four of the speakers are shown at the second annual New Mexico Agricultural Chemicals Conference held on the State University campus Feb. 4 and 5. Left to right are: Dr. J. G. Watts, head, department of botany and entomology, NMSU; A. S. Curry, agricultural experiment station, NMSU; Dr. Robert L. Beacher, Southwest Regional Director of the National Plant Food Institute; and Joseph Diaz of Shell Chemical Company.

THE HEPTACHLOR INSECTICIDE 1959 DEALERS' "SALES-BUILDER" PROGRAM

The Most Comprehensive Insecticide Sales Support Ever Offered!

INSECT CONTROL REFRESHER COURSE—This simplified nine lesson course covers insect control information that you and your employees can use to increase sales.

INSECT CONTROL GUIDE SHEETS—Each sheet describes the appearance, life cycle, habits, damage and control of a specific insect.

INFORMATION SERVICE—A periodical newsletter will bring you the latest insect control information, and provide a continuing source of selling ideas.

ADVANCE COPIES OF PROMOTIONAL LITERATURE—As a participating dealer, you will receive advance copies of Heptachlor literature and promotional materials.

NO PURCHASING REQUIRED!—Whether you now sell insecticides containing Heptachlor or not, you are eligible for this program. There's no cost or obligation!

CHLORDANE PROGRAM—If you sell lawn and garden insecticides, send for complete information about the Chlordane "100% Sales Support" Program for small package dealers.

FORMULATORS... DISTRIBUTORS... MAIL COUPON FOR COMPLETE DETAILS!

The Heptachlor sales-builder program provides a continuous flow of educational and sales information. It will help salesmen and dealers during the busy spring and summer season, and give them a wealth of sales training material to use during the fall and winter. Mail the coupon now for complete details.

VELSICOL

VELSICOL CHEMICAL CORPORATION
330 East Grand Avenue, Chicago 11, Illinois

Please send complete information about the Heptachlor Dealer "Sales-Builder" program. ☐ Formulator ☐ Distributor ☐_____

AC-19

Name_____

Company Name_____

Address_____

City_____ Zone_____ State_____

PLEASE PRINT

LCPT begins here . . . with better bags and more efficient packing. St. Regis specialization helps assure you of both

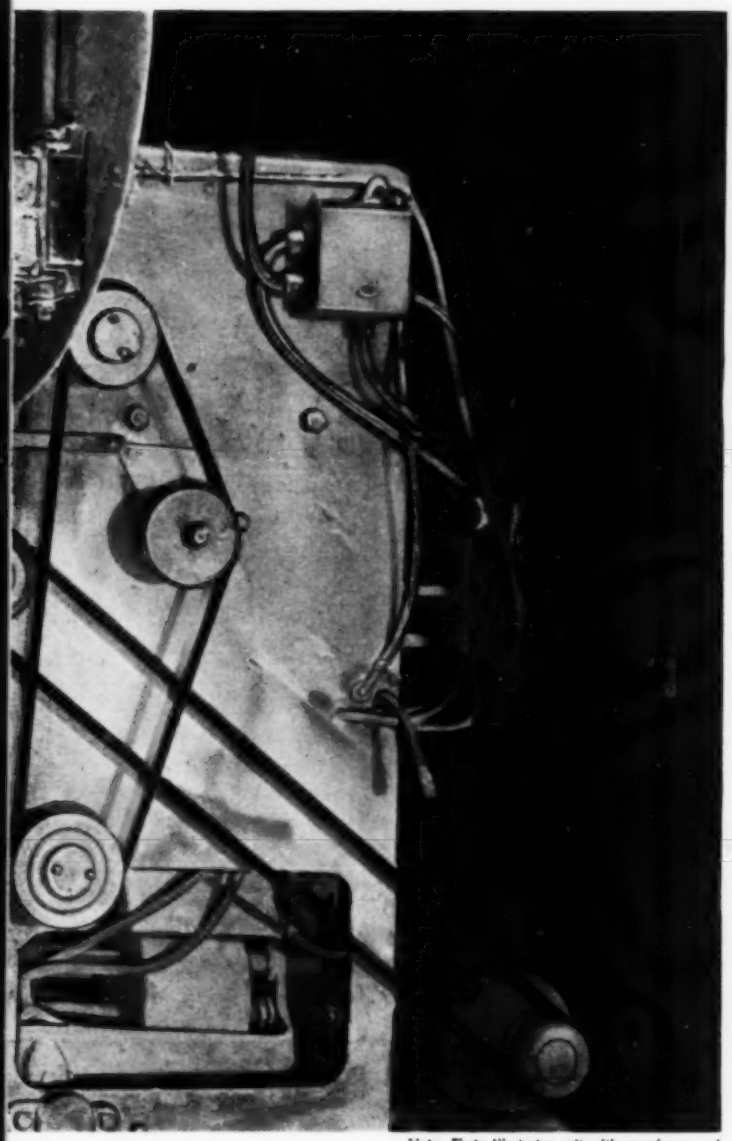
LCPT* is in the bag...

***Lower Cost Per Ton**

In today's competitive market, key to fertilizer profits is *lower cost per ton packing*. You can begin saving by using pasted valve multiwall bags by St. Regis—whether you pack fifties, eighties or hundreds.

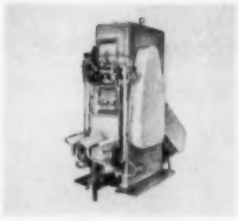
St. Regis Pasted Valve Bags save you money four important ways:

1. **SAVE** on storage because they're squared up on all four sides to save warehouse space, save on shipping costs.
2. **SAVE** losses from wastage. The new insert sleeve closes tight against the bag top to cut down siftage, promote cleaner bags.
3. **SAVE** in-storage losses, because the asphalt laminated sheet locks out moisture, assures effective, positive protection against caking.
4. **SAVE** excessive inventory of unfilled bags, because St. Regis' 8 convenient plants make bags available when you want them.



Note: Photo illustrates unit with guard removed

LATEST and most efficient valve bag packer for the fertilizer industry, the St. Regis 161FB Valve Bag Packer packs as high as 22 bags per minute with almost-automatic precision of weight control and bag cleanliness.



DESIGN that helps in the merchandising of your product is a specialty of the St. Regis Pensacola, Florida, plant Shown here is portion of the bag design room where selling designs are developed.

SPACE SAVER St. Regis Pasted Valve Bags are squared off – stack better, ship more compactly to save time, space, handling costs.

SELLING PACKAGES—note how St. Regis Pasted Valve Multiwall Bags give you display on all sides for your brand name and product information.

when it's a valve bag by ST. REGIS

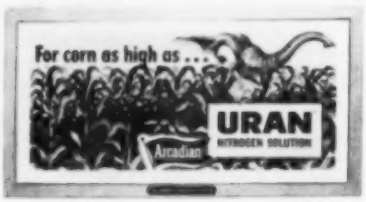
That's only the beginning! St. Regis bag packing machinery brings lower cost per ton, too. The 161FB Valve Bag Packer, for example, packs as high as 22 bags per minute–can pack from 25 lb. to 100 lb. bags. It fills, weighs and discharges bags automatically. All the operator does is place empty bags on the filling tubes. A built-in settler compacts the bag contents during filling to permit use of smaller bag sizes.

A St. Regis Sales Engineer can examine your packing method, analyze your present bags and filling equipment–and show you how to make appreciable reductions in your cost per ton figures. Why not call him in today? See for yourself what St. Regis offers. Better bags. Better ways to fill them. Printed bag designs that help merchandise your product at the point of sale. If you pack in open mouth bags, ask for his help there.

In multiwall packaging, St. Regis means lower cost per ton.

St. Regis PAPER COMPANY
150 EAST 42ND STREET, NEW YORK 17, N. Y.

Nitrogen Fertilizers Poster



The Nitrogen Division of the Allied Chemical Corp., New York, is sponsoring an outdoor advertising program to cover farming areas in 35 states. Posting in the Lower Mississippi Valley and in the Southeast got underway last month. It is starting in other areas just before spring planting.

•

New Geigy Iron Chelate

Geigy Agricultural Chemicals, Division of Geigy Chemical Corp., Ardsley, N.Y., last month announced the commercial introduction of Sequestrene 138 Fe iron chelate.

Field testing carried out by Geigy, in cooperation with the University of Arizona and the University of California, has indicated that Sequestrene 138 Fe iron chelate is effective in correcting and preventing iron chlorosis in citrus and avocados in the alkaline soils of Southern California and Arizona.

•

Texaco Names Creasy

Rudolph C. Creasy has been appointed Texaco's petrochemical sales representative to fertilizer manufacturers and other users of ammonia and nitrogen solutions in Missouri, Kansas, and Arkansas. His headquarters are at the Texas Co.'s central region sales office in Chicago.

Before joining Texaco, Mr. Creasy had been with the Chemagro Corp.

•

Va. Recommends Glyodin

Glyodin fungicide is now recommended for use in all seven apple cover sprays, according to the 1959 Virginia Spray Bulletin, published by the Virginia Agricultural Extension Service. Glyodin has been recommended for a number of years in combinations for both pre-bloom and petal fall sprays. However, this fungicide had been suggested only through the third cover in Virginia apple spray programs.

Field tests and reports from growers in recent years have indicated that Glyodin combined with ferbam provided effective disease control and greater economy for apple producers in later cover sprays. The new spray bulletin lists Glyodin at one-and-one-half pints per 100 gallons of spray in combination with phenylmercury fungicide in the pre-bloom and petal fall sprays. In first and second cover sprays, Glyodin is recommended at one quart per 100 gallons.

•

Neguvon As Sheep Drench

Laboratory experiments conducted by the Commonwealth Scientific and Industrial Research Organization, East Melbourne, Australia, indicate that Neguvon (also known as Dipterex or Bayer L13/59), at a dose rate of 2.5 grams per 100 pound body weight, was very effective against the large stomach worm in most sheep.

Occasionally, however, it failed completely and in some sheep it had only slight effects.

Tennessee Demonstration

An average of 83 bushels of corn per acre was produced by 40 Tennessee farmers on 308 acres in a fertilizer demonstration conducted by the Tennessee agricultural extension service. The average corn yield for the state during the same period, 1958, was less than 30 bushels per acre.

•

French Firm Seeks Capital

Societe Le Foudroyant, a limited liability company at 50 Rue Marcelin Jourdan, Cauderan, Gironde, France, manufacturer of agricultural insecticides, fungicides, and weed killers, wishes to enter into a business agreement with a U. S. firm, with a view towards expanding and diversifying its production.

•

TVA Process To Armour

The Armour Fertilizer Works, Atlanta, Ga., has obtained a license from the Tennessee Valley Authority for the use of process and apparatus for the ammoniation of superphosphate.

More Research Needed to Solve Citrus Problems

Increased research to solve major citrus problems was urged by a nationwide industry committee meeting last month at the University of California, Riverside.

The U. S. Department of Agriculture's citrus and subtropical fruit research and marketing advisory committee suggested strengthening research on citrus variety evaluation and breeding, rootstocks, nematode control, control of insect pests, use of radiation against fruit flies, and mechanization of harvesting. Members of the committee pointed to the need for new citrus varieties to lengthen the season for fresh fruit and processing in all citrus areas.

Control of insect pests was deemed increasingly important if the citrus industry is to produce high quality fruit, the group said. It urged special emphasis on biological control, studies of selective insecticides that are least harmful to beneficial insects, and basic research on the mounting resistance insects are said to be showing to insecticides.

Dr. A. M. Boyce, director of the University of California Citrus Experiment Station, was host to the gathering along with Paul F. Sharp, director of the California Agricultural Experiment Station.

Monday the group heard a capsule review of CES research on citrus by department representatives. P. H. DeBach, R. L. Metcalf, Walter Reuther, W. B. Sinclair, S. A. Sher, J. T. Middleton and H. D. Chapman. R. G. Platt, Extension subtropical horticulturist, described the Extension Service's field work on citrus problems.

Research on the University's Los Angeles campus was described by S. H. Cameron, chairman of the department of subtropical horticulture, and R. L. Perry, agricultural engineer.

Fairfield Offers Formulas

Formulations aimed at increasing the effectiveness of household, garden, and truck crop insecticides are being offered in a folder prepared by Fairfield Chemicals, Food Machinery and Chemical Corp., New York.

The folder lists suggested formulations for dual purpose home and garden sprays, horticultural sprays, fungicide additives, emulsifiable garden sprays and concentrates, and garden and truck crop dusts.

•

Yugoslav Fertilizer Plant

Two Italian companies, Montecatini and Ansaldo, have signed a contract with the Yugoslavian Rudnap Company for the construction of a nitrogen fertilizer plant at Lukavaz in Bosnia. Construction was scheduled to begin immediately.

The plant will produce 100 metric tons per day of anyhdrous ammonia by the Fauser-Montecatini processes. Societa Ansaldo of Genoa is supplying the equipment and machinery.

•

Miller 658 For Leaf Spot

Miller 658 Fungicide is said to have produced one of the top yields on tomatoes in the 1958 tests for gray leaf spot control conducted on the Eastern Shore of Maryland by the U. of Maryland Experiment Station.

•

Kelthane Price Reduced

The Rohm & Haas Co., Philadelphia, has reduced the price of its Kelthane W miticide approximately 14 per cent below the 1958 price schedule.

•

Cyanamid Lab. In Geneva

The American Cyanamid Co., New York, has announced the completion of plans for a basic research laboratory, Cyanamid European Research Institute, Inc., to be built in Geneva, Switzerland.

Dr. Robert C. Swain, Cyanamid's vice president for process development and research, said that the Geneva laboratory will serve primarily as an "idea factory." It will have a small staff of European scientists whose work will be directed toward the uncovering of new scientific information.

•

Agrico Names Two

The American Agricultural Chemical Co., New York, has announced that J. H. Dorsey, formerly Agrico representative in south central Pennsylvania, has been named assistant branch manager at Agrico's Cairo, Ohio plant.

In another appointment by the company, Dr. Donald P. Satchell was named to the service division staff with headquarters in New York. Dr. Satchell previously was on the agronomy staff at Pennsylvania State University, specializing in crop fertilization and management.

•

Two Join Geigy

Howard S. Beaudoin has joined the field research staff of Geigy Agricultural Chemicals, Division of the Geigy Chemical Corp., Ardsley, N. Y. He is assigned to the Pacific Northwest area.

Formerly Deputy State Entomologist in Wyoming, Mr. Beaudoin most recently was with the Velsicol Chemical Corp., Chicago, as technical sales representative for the Northwestern states.

Also, last month, John J. Paredes, former sales supervisor for the special chemicals department of Monsanto's Organic Chemical Division, joined the sales department of Geigy Industrial Chemicals.

•

Test Thimet On Peanuts

Thimet, a systemic insecticide, is being tested by the Alabama Polytechnic Institute, Auburn, for the control of insects on peanuts. The American Cyanamid Co., New York, reports that research workers at Auburn are enthusiastic about the control of thrips and leafhoppers on peanuts with Thimet. American Cyanamid is cooperating with Auburn in field demonstrations.

F&P Sales Coordinator

Horace F. Richter Jr. has been named to the newly-created post of sales coordinator by the Fischer & Porter Co., Hatboro, Pa. He has been with the company for 19 years.

In his new position, Mr. Richter will implement F&P sales policies, coordinating operating activities between the company's home office and its field force.

•

Stauffer Shifts Two

Stauffer Chemical Co., New York, has named George O. Voss to the position of sales manager, Southeast, Agricultural Chemicals Division and Wayne Kincannon has been named sales manager, Delta Area, Agricultural Chemicals Division.

Mr. Voss is headquartered at Tampa, Florida and Mr. Kincannon is located at North Little Rock, Arkansas.

•

Cherry Leaf Spot Control

Glyodin and Ferbam are reported to have offered outstanding control of cherry leaf spot when the two materials were used in combination in tests conducted at Michigan State University.

When applied separately, the materials were not as good as the combination, according to Donald Cation, a research specialist of the university, who tested a number of fungicides for control of cherry leaf spot.

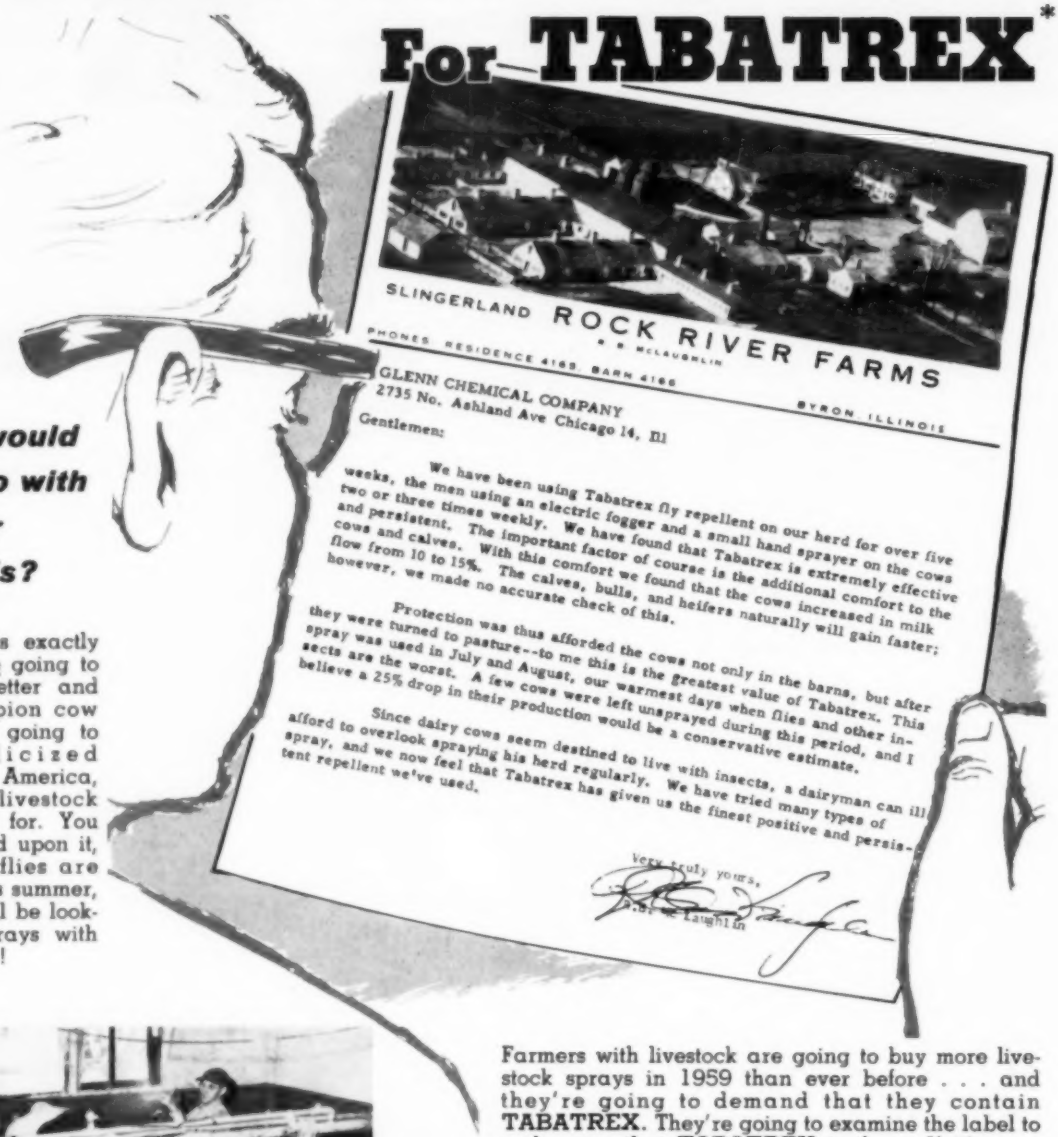
•

Pyrethrum Stocks Offered

Insecticide suppliers will be given an opportunity to purchase part of the national stockpile of pyrethrum extract from the General Services Administration.

The GSA plans to offer about 66,000 pounds of the 20 per cent grade extract in about six months. It has been decided by the Office of Civil and Defense Mobilization that there no longer is any need to stockpile this quantity of pyrethrum. GSA plans to channel the product to the pyrethrum processors at current market prices over a twelve-month period.

A LETTER + A COW =
A Powerful Advertising Program
For TABATREX*



What would you do with a letter like this?

Well, that's exactly what we're going to do. This letter and the champion cow below are going to be publicized throughout America, wherever livestock are cared for. You can depend upon it, when the flies are buzzing this summer, farmers will be looking for sprays with TABATREX!

Herdsman at Rock River Farms uses TABATREX spray on Champion Haven Hill Crescent Gewina Count, National Holstein Fat Leader Over All Ages.

Farmers with livestock are going to buy more livestock sprays in 1959 than ever before . . . and they're going to demand that they contain **TABATREX**. They're going to examine the label to make sure that **TABATREX** is there. If it's your product they're looking at, be sure they see the word they're looking for . . . **TABATREX**.

G Tabatrex INSECT REPELLENT *Trademark

Register your label now. For complete information and labeling, write or call:

GLENN CHEMICAL CO., INC.
2735 N. Ashland Avenue, Chicago 14, Illinois
EAstgate 7-9350

Hazleton Renames Service

Hazleton Laboratories, Inc., Palo Alto, Calif., has changed the name of its growers service department to GRS. The name is derived from the initials of the commonly-used term for the department's function, growers residue service.

The service is used by western growers to determine whether their crops comply with official pesticide tolerances. T. O. Tuft is manager of the department which recently named the Valley Laboratories of Phoenix, Arizona, as field sampling agent for its service in that state.

•

Allied Weather Bulletins

Nitrogen Division, Allied Chemical Corp., New York, has begun distribution of monthly weather forecasts to its fertilizer dealers and manufacturer customers all over the country. The forecasts for each month are mailed about a week before the month begins.

The forecasts, said to be 80 per cent accurate, are prepared for Nitrogen Division by Weather Trends, Inc., one of the oldest private weather forecasting services in the nation.

In addition to a summary giving over-all weather predictions, each forecast will include colored charts and maps showing expected precipitation and temperatures in each section of the country.

•

OK Dri-Die Registration

The Davison Chemical Division of W. R. Grace & Co., Baltimore, Md., has begun nationwide distribution of Dri-Die Insecticide 67 following approval by the U. S. Department of Agriculture of the product label.

Approval has been allowed on the killing and control of roaches, drywood termites, and animal fleas. Dri-Die is a highly porous silica gel of micron-sized particles. A small quantity of ammonium fluosilicate is impregnated on the internal surfaces of the gel. Upon contact, the dust removes a portion of the waxy body surface of the insect, destroying its moisture balance. According to Davison, the product also controls other species of insects, such as house flies, two-spotted mites, stored grain insects, ants, poultry lice, and grasshoppers.

•

Named To International Post

E. R. Marshall has been named technical manager, Agricultural Chemicals (International), for the Union Carbide Chemicals Company, Division of Union Carbide Corp., New York.

Dr. Marshall will serve the overseas development and promotion of Union Carbide's product line of agricultural chemicals. He will headquarter with the Crag Agricultural Chemicals sales staff at White Plains, New York.

•

Sulfur Output Down

Total production of sulfur from all sources in the United States during 1958 amounted to approximately 6.2 million long tons, compared with 7 million in 1957, according to the annual report of the Texas Guf Sulphur Co., New York.

The report traced the decline in production to lower demand resulting from the recession, an increase in sulfur imports, and a gain in the output of recovered sulfur. Texas Gulf began production at a new Frasch-process mine at Fannett Dome, Texas during 1958 and, under an agreement with Shell Oil of Canada Ltd., Texas Gulf and Devon-Palmer Oils Ltd. is constructing a sour gas recovery plant at Okotoks, near Calgary, Alberta.

•

Abbott Labs. Appoints Three

The Abbott Laboratories, North Chicago, Ill., has announced the appointments of three research workers. Dr. Marlin T. Leffler has been appointed director of exploratory research and will continue to be in charge of nutritional research and the research farm.

Dr. Kenneth E. Hamlin has been named director of chemical research, and Dr. Robert W. Rivett now is director of development.

Named To Florida Sales

Maury W. White has been named an agricultural sales representative for Florida by the Nitrogen Division of the Allied Chemical Corp., New York. Mr. White joined Nitrogen Division last July and had been a sales trainee at the division's Hopewell, Va., office. He has worked with the Virginia Agricultural Experiment Station coordinating experimental work with farmers.

•

Dow Quack Grass Movie

The Dow Chemical Co., Midland, Mich., has prepared a motion picture about the control of quack grass. The film, entitled "Quack Grass, The Perennial Guest", shows the control of this grass in various crops with pre-plant, post harvest, or in-crop applications of Dowpon.

The film is available for free bookings to farm groups, schools, and others from Modern Talking Picture Service, New York 22, N. Y.

•

Fertilizer Placement Slides

How the farmer places his fertilizer can mean the difference between a full crop, a poor crop, and no crop at all, according to a new slide set on fertilizer placement issued by the American Potash Institute, Washington, D. C.

The color set was prepared for use by agricultural advisors in classroom work, agricultural meetings, conventions, short courses, etc. It is a 35mm set, with 40 pictures and script, illustrating the objectives and principles of proper fertilizer placement on row crops, forages, and small grains.

The set is available at cost, which is $4.00, or on loan for 10 days.

•

Calspray Awards Contracts

The California Spray-Chemical Corp., Richmond, Calif., has awarded contracts for two major processing units for its proposed fertilizer plant at Kennewick, Wash. The Chemical and Industrial Corp. of Cincinnati, Ohio, will build both the nitric acid plant and the ammonium nitrate plant at Kennewick.

WONDERWALL™ cuts by up to 90% for

Mr. Campbell (standing) and Mr. C. L. Pickhardt, National Gypsum transportation engineer, check on WONDERWALLS loaded in a freight car.

"WONDERWALL bags have helped us reduce breakage as much as 90%," states Mr. Robert Campbell, Manager of Packaging, Products Division, National Gypsum Company, Buffalo, N. Y.

"We estimate our present breakage rate with the WONDERWALL bag at less than one bag in a carload of 600 units. This is a reduction of 90% in our previous breakage rate in shipments going to certain difficult destinations.

"This improvement in package durability was accomplished without increasing the unit cost of the bags. There's no way to estimate the value to this company of the goodwill

The WONDERWALL places quickly on the packing spout because the Clupak extensible paper used to make this multiwall is so flexible. This flexibility also allows the bag to be handled easily.

The resiliency of the new kraft paper resists the weakening effects of plant handling, keeps the bags in better shape to withstand the shock of shipping.

bag breakage National Gypsum

gained by eliminating this sore spot in customer relations.

"West Virginia's WONDERWALL bag has won our wholehearted approval from both the performance and cost standpoints. Its success has prompted us to change bag specifications so as to use extensible type paper bags in all thirteen of our plants making plaster products."

WONDERWALL is the great new multiwall bag from West Virginia Pulp and Paper. WONDERWALLS outperform ordinary multiwall bags because they are made of Kraftsman Clupak* Paper—the new, extra tough kraft that stretches. WONDERWALLS pack faster, handle easier and stack better, too.

Try this superior, new multiwall. Order a trial shipment of 5000 WONDERWALLS on your next carload. Write Multiwall Bag Division, West Virginia Pulp and Paper Company, 230 Park Ave., New York 17, N.Y.

See it at our exhibit,
AMA Packaging Exposition, Chicago

West Virginia Pulp and Paper

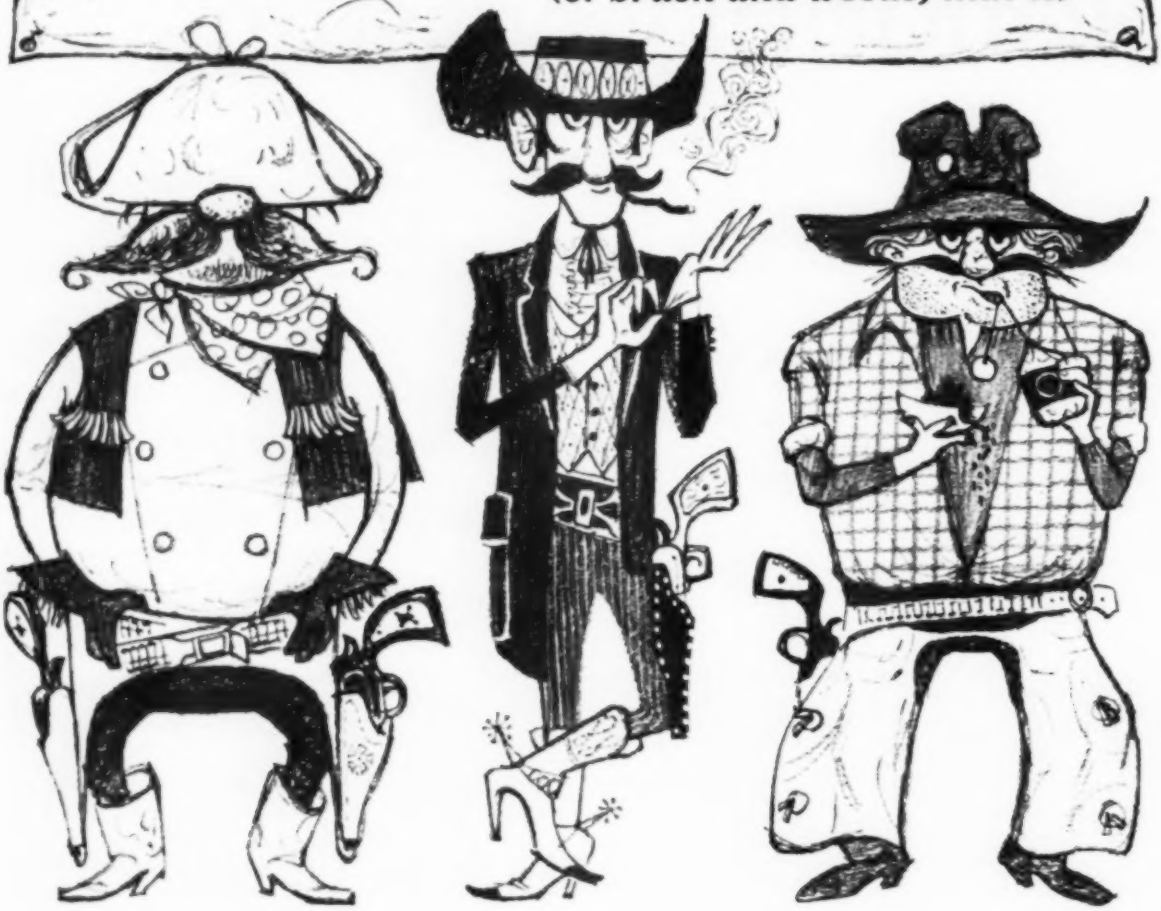
**Clupak, Inc.'s trademark for extensible paper manufactured under its authority.*

In some cases National Gypsum stores the bags before shipment, stacking them three to four pallets high. This places a 6000 pound pressure on the bottom bags, but the extra tough WONDERWALLS do not break.

WONDERWALL™
Best bag of all

AMERICA'S 3 MOST "WANTED" KILLERS

(of brush and weeds, that is)



The "LINE RIDER"

Specializes in knocking off brush and weeds found along utility lines, railways and highways. Destroys mixed brush with 2-Ethyl Hexyl Ester formulations of 2,4-D and 2,4,5-T, and amine formulations in areas adjacent to sensitive crops.

The "FENCE RIDER"

Picks on isolated farm fence rows. Where volatility is no problem, uses the Butyl Ester formulations of 2,4-D and 2,4,5-T for economical kills of mixed brush. Attacks solid, resistant stands with higher acid formulations of 2,4,5-T. Low volatile formulations also available.

The "CROP RIDER"

He's the weed specialist. Favorite hunting grounds are grain fields and pastures. Seeks out weeds in oats, flax and rice with amine formulations. Boosts yields of corn and sorghums with Isopropyl Ester. Uses Butyl Ester for hard-to-kill perennials.

LINE RIDER, FENCE RIDER and CROP RIDER herbicides are available now in quantity for formulators and professional applicators. Write for complete technical data. Diamond Alkali Company, 300 Union Commerce Building, Cleveland 14, Ohio.

Diamond Chemicals

Name Thibodeau Manager

Louis-Phillipe Thibodeau has been named manager of Quebec Fertilizers Inc., Pointe Aux Trembles, Quebec. He had been employed by the Canadian Department of Agriculture and, most recently, was manager of the fish meal and oil processing firm of G. M. Conapro Ltd. located at Grindstone, Quebec.

•

Carbide Names Four

Bruce A. Gustin Jr., George S. Cooper Jr., Theodore J. Hamilton, and James R. Retter have been named in personnel shifts by the Union Carbide Chemicals Co., Division of Union Carbide Corp., New York.

Mr. Gustin, formerly manager of the Boston district, has been named Eastern division manager. Mr. Cooper, who had been a technical representative in the New York district, now is assistant manager of that district.

Mr. Hamilton has been named district manager of the Albany district. He had been a technical representative in the Philadelphia district. Mr. Retter, formerly Albany district manager, now is manager of the Boston district.

•

Name Cyanamid Products

The American Standards Association has authorized the use of common names for two products of the American Cyanamid Co., New York. The names are Thimet and Cyprex.

Thimet, an insecticide, has been referred to in experimental writings as test material 3911. Cyprex, a fungicide, was known as 5223.

•

Randox, Simazin in Tests

Harley Otto, a University of Minnesota extension agronomist, has reported that Randox and Simazin, among others, did a good job of controlling annual grass weeds in corn in tests conducted last summer. The aforementioned chemicals were among those used in 93 weed control demonstrations set up in cooperation with county agents and farmers.

The demonstrations also indicated that Randox and 2,4-D in combination usually will control both annual grasses and broad-leaved weeds and that either TCA or Dalapon will control annual grasses in flax. 2,4-DB, is said to look promising for the control of broad-leaved weeds in flax or small grains which have been interseeded with a legume.

•

Brewster To Chase Board

John A. Brewster has been named to the board of directors of the Chase Bag Co., New York. He is vice president-director of West Coast operations for the company. Mr. Brewster joined Chase in 1921.

•

Container Plant Operating

The Southwestern Steel Container Co., Dallas, Texas, has started production of steel pails and drums for the paint, chemical, food, and petroleum industries.

The firm is manufacturing all popular sizes, gauges, and types of pails, one to seven gallon capacity, with Hi-Bake linings. A production line for 15 to 55 gallon drums is scheduled to be installed shortly.

Occupying Hooker Center

Research workers have moved into the Hooker Chemical Corp.'s new research center facing the west branch of the Niagara River at the north end of Grand Island, N. Y. The research department had been located at Hooker's plant in Niagara Falls, N. Y.

Dedication and formal opening of the research center is planned for next May. Except for some minor features and landscaping, construction now is completed on the center which provides space for about 200 people.

•

Soil Conservation Meeting

The Soil Conservation Society of America will hold its 14th annual convention August 26-29, 1959 in Rapid City, South Dakota. Emphasis will be placed on soil and water conservation problems and practices of the nation and in Canada.

•

Bemis Revamps Department

The Bemis Bro. Bag Co., St. Louis, Mo., has reorganized its general engineering department by dividing its functions into three separate areas of responsibility; engraving and printing, general operations, and design and development.

Delegates at N.P.F.I. Mid-West Meeting Feb. 12.

Top row, left to right, are: Dr. M. D. Weldon, U. of Nebraska; Arlan Woltemath, NPFI; Dr. L. O. Fine, South Dakota State College; Dr. M. S. Williams, NPFI; Rein Mesdag, South Dakota State; W. T. Dibble, International Minerals & Chemicals Corp.; and Dr. Kermit Berger, U. of Wisconsin.

In the bottom row, left to right, are R. P. Thomas, IMC; J. A. Naftel, U. S. Borax & Chemical Co.; R. E. Bennett, Pres. NPFI; Dr. Russell Coleman, Exec. V. P., NPFI; Dr. W. P. Martin, U. of Minnesota; Zenas Beers, NPFI; Robert Parks, Grace Chemical Division; and W. R. Allstetter, V. P., NPFI.

Together with phosphate products...

Cyanamid supplies the kind of service you can use

Cyanamid mines phosphate rock and manufactures triple superphosphate and phosphoric acid. That's our business. Since 1905, supplying mixers and manufacturers has been our *only* fertilizer business. Because we know fertilizers, we're in a position to contribute in special ways to *your* products. For example, our people are ready...and able...to help integrate Cyanamid phosphate products into your operation, and to help you get more out of your plant than ever before. Their training in fertilizer manufacture includes experience in hundreds of plants using many different processes. Long experience also enables us to route shipments from our Florida Plant for quickest delivery, whenever you desire this service. And, Cyanamid specialists are ready to serve you *wherever* you are located. Simply call, wire or write. These pictures show one of these specialists contributing his experience to some of our customers. American Cyanamid Company, Phosphates and Nitrogen Department, N.Y. 20, N.Y.

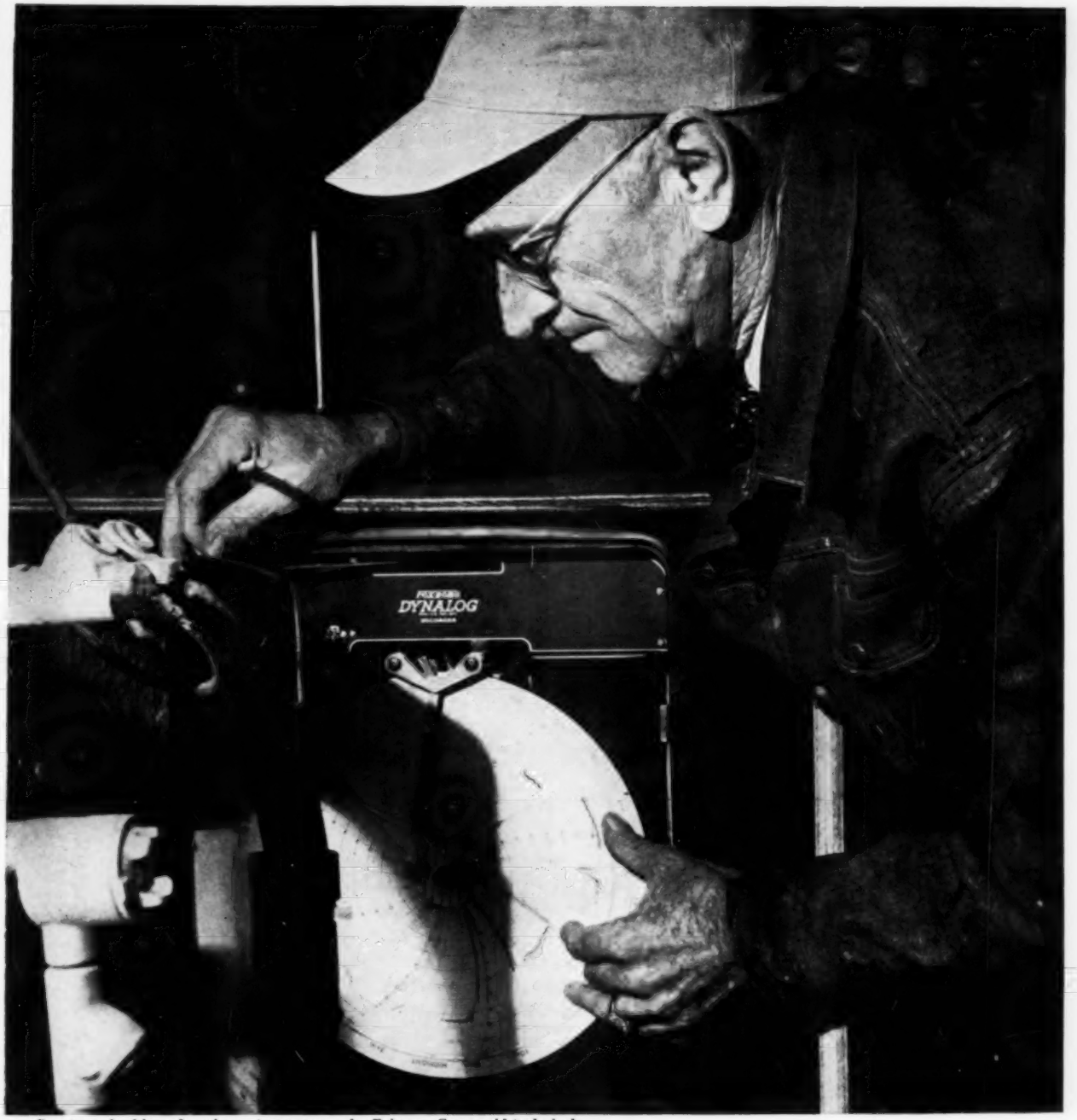
Here's where Cyanamid service pays off...in better mixed fertilizers. This run, inspected by a Cyanamid representative, was made with TREBO-PHOS triple superphosphate. Grade and uniformity: excellent.

Formulas are usually discussed in the office, but Cyanamid technical service people are adaptable, work where you work. Their experience has been developed in many plants. Often, what are new problems to you are solved-problems to them.

Cyanamid technical representatives are trained in all phases of fertilizer manufacture. They can follow your process through from our delivery to yours. Here the Cyanamid man checks with chemist analyzing samples of mixed fertilizer before bagging.

Cyanamid traffic experts are experienced at routing phosphate shipments to eliminate avoidable delays, cut demurrage, keep your plant humming along on schedule.

To manufacture fertilizers that sell...



Constant checking of equipment assures peak efficiency. Cyanamid technical service man interprets meter reading. He often can suggest changes in procedure that result in better mixed goods, produced more economically.

mix with Cyanamid's Phosphates and Service

TREBO-PHOS* TRIPLE SUPERPHOSPHATE
PHOSPHATE ROCK | PHOSPHORIC ACID

*Trademark

CYANAMID
PHOSPHATE PRODUCTS

HOW TO GET THE MOST FOR YOUR FERTILIZER MACHINERY DOLLAR

Before You Buy, Check Sturtevant's Answers to These Key Questions

Q - How much experience is built into the design?

A - You get the benefit of 84 years of practical fertilizer industry experience in each Sturtevant machine you buy. Unrivaled for fertilizer plant engineering know-how, Sturtevant originated the 'Unit' idea. Whether your need is for a replacement pulverizer or mixer, or a completely modern granulating unit, Sturtevant-engineered machinery always can be depended upon to fit your requirements like a glove.

Q - Is the machinery engineered for peak-load efficiency?

A - All details in each Sturtevant machine have been proved by years of peak-load performance in fertilizer plants. Rugged construction that withstands the most slam-bang use, gears designed to always perform dependably, bearings that stand up under the heaviest loads, all can be taken for granted in Sturtevant machinery. Many Sturtevant machines have been operating at top capacity and efficiency for well over a quarter of a century.

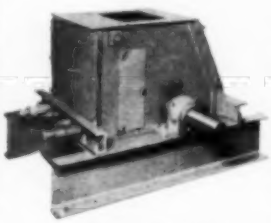
Q - How accessible is the machinery for clean-outs and repairs?

A - Clean-outs are a constantly recurring problem in the operation of a fertilizer plant. And minor repairs on hard-to-get-at machinery can consume hours of costly man and production time. Sturtevant's practical "Open-Door" design guarantees quick accessibility — for clean-outs and repairs. Any parts requiring cleaning or maintenance are quickly exposed by "One Man in One Minute".

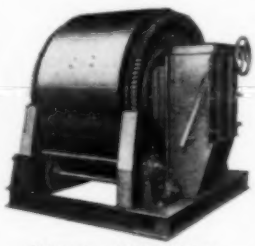
For rugged, reliable, efficient machinery you can depend upon for years — or for engineering assistance in planning or upgrading your fertilizer unit — it will pay you to consult Sturtevant. Write to STURTEVANT MILL COMPANY, 123 Clayton St., Boston 22, Mass.

ELEVATOR

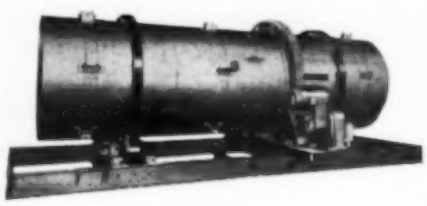
B-B SCREEN



ROTARY PULVERIZER



MIXER - AMMONIATOR



GRANULATOR

COMPLETE GRANULATION PLANTS
MIXING and SHIPPING UNITS
DEN and EXCAVATORS
CONVEYORS
FEEDERS and OTHER ACCESSORIES
MICRON GRINDERS
AIR SEPARATORS
CRUSHERS and GRINDERS

For further information, write Sturtevant today.

STURTEVANT MILL CO.

Dry Processing Equipment

The "OPEN-DOOR" to *lower* operating costs over *more* years

BREVITIES

REPRESENTATIVES of New Jersey's 17 county mosquito commissions met at Atlantic City March 18 to 20 for the 46th annual convention of the New Jersey Mosquito Extermination Association. Nearly 40 authorities on mosquito control and related subjects appeared on the program.

AC

NORTH LOUISIANA CHEMICALS, INC. has announced plans for a new plant at Gillian, La., for the manufacture of cotton insecticides and defoliants.

AC

B. P. REDMAN JR. has been elected president of The Farmers Fertilizer Co., Columbus, Ohio. H. J. Thomas has been named secretary and M. Y. Cooper II is treasurer. H. E. Wood, vice president, has retired.

AC

HOWARD L. MARSHALL, INC., a lime and fertilizer dealership in Louisa, Va., has been granted a charter of incorporation. The firm also conducts a spreading operation in Louisa County and parts of Fluvanna, Orange, Hanover, and Spotsylvania Counties.

AC

THE AMERICAN AGRICULTURAL CHEMICAL CO., New York, has announced that John A. Marsh, vice president of the International Nickel Co. and W. H. Hildebrandt, comptroller of Agrico, have been elected to the company's board of directors.

AC

ABEL A. SARASOLA and his wife, Maria, have joined the staff of the Connecticut Agricultural Experiment Station, New Haven. The couple is from Argentina and will spend a year at the Connecticut station. Mr. Sarasola had been general director of plant pathology for the Province of Buenos Aires, Argentina, and his wife was in charge of the provincial laboratory of plant pathology in La Plata.

MARK MEANS CO., INC., dry fertilizer, feed and seed firm, has purchased the Lewistown (Idaho) operations of Columbia Farm Supply.

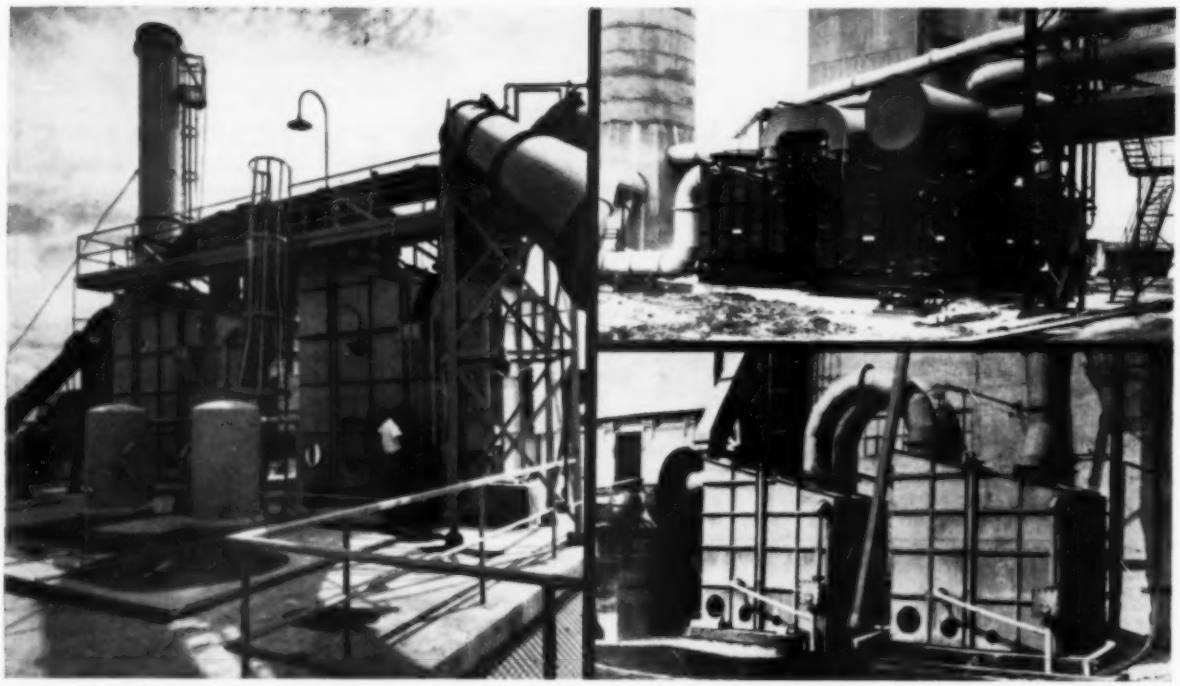
AC

A FEDERAL TRADE COMMISSION hearing examiner ordered dismissal of charges that Fulton Bag and Cotton Mills, Atlanta, and Equitable Paper Bag Co., Long Island City, N. Y., conspired to fix the prices of multi-wall paper shipping sacks.

typical fertilizer
plant installations
prove efficiency of the

DOYLE SCRUBBER

for removal of solids and fumes
from gas streams



American Cyanamid Co., Brewster, Fla.

Top photo: Scottish Agricultural Industries, Ltd., Leith, Scotland.
Lower photo: Norske Zinkkompani A/S, Odda, Norway.

• *simple design* • *high scrubbing efficiency* • *low water requirements*

The Doyle Scrubber provides a highly efficient yet extremely simple, compact and rugged means for removing solids and fumes from gas streams. It is particularly adapted to fertilizer plant applications, including treatment of waste gases from phosphate fertilizer driers and several other operations. Its versatility is demonstrated in such additional applications as fume control in smelters, treatment of SO_2 gas prior to acid manufacture, ammonia recovery and possible use in fly ash collection.

The Doyle design makes possible high solids concentration in the scrubber effluent, a low water requirement and high heat transfer rates. Its efficiency has been conclusively proved in several installations. Doyle Scrubbers are constructed, sold and installed under license by Dorr-Oliver. They make an important addition to the extensive line of D-O equipment already offered to the fertilizer industry. For full information, write to Dorr-Oliver Incorporated, Stamford, Connecticut.

DORR-OLIVER
INCORPORATED
WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT
STAMFORD • CONNECTICUT • U.S.A.

Equipment, Supplies, Bulletins

Un-mounted Bes-Kil Aerosol Insect Sprayer

A new model of the Bes-Kil aerosol insect sprayer is being offered by the Besler Corp., Oakland, Calif. The new model is skid-mounted and without a tank, but otherwise is identical to the company's trailer mounted models.

The machine is an adaptation of smoke screen machines made by Besler for the U.S. Navy. A feature of the Bes-Kil cited by the manufacturer is that it also can be used as a wet-spray machine, with a spray boom or by hand, and to sterilize such buildings as barns.

•

New Highway Spreader

New literature on the "Challenger Lime and Fertilizer Spreader" is now available through the manufacturers, Highway Equipment Company, Cedar Rapids, Iowa.

The "Challenger" is a positive feed, self-unloading lime and fertilizer spreader, which offers either a single spinner with an 18-inch conveyor or twin spinners with a 24-inch conveyor. Complete literature can be obtained by writing to Highway Equipment Company, Dept. A3-5, 616 D Avenue N.W., Cedar Rapids, Iowa.

•

Noble Granule Applicator

A new applicator for granular soil insecticides is being offered by the Noble Manufacturing Co., Sac City, Iowa. The unit's main element is a 50 pound capacity hopper.

One hopper is used for every two or three rows being worked, powered by the drive shaft of the planter, lister, or seeder to which it is attached. Flexible steel drop tubes direct the granules into the proper position on the soil.

Wisconsin Alumni Bulletin

The Wisconsin Alumni Research Foundation, Madison, Wisc., has prepared an attractive booklet describing its operations and organization. In addition, WARF is offering a series of folders covering specific services and experiments carried on by its laboratories.

•

New F&P Flowmeter Catalog

A six-page catalog issued by the Fischer & Porter Co., Hatboro, Pa., lists complete information on the company's obstructionless magnetic flowmeter for metering liquids such as concentrated acids and alkalis, slurries, paper pulp, waste sludges, sewage, pigment dyes, starch solutions, food products, and black liquor.

The catalog, which discusses principles of operation and advantages of the new meter, is available from the company at 1149 County Line Road, Hatboro.

•

Delaware Control Folders

Insect and disease control recommendations for vegetables, orchards, and home plantings in Delaware have been published in Extension Folders 48 and 49 by the Agricultural Extension Service of the University of Delaware, Newark, Del.

Dow Research Catalog

A new edition of the catalog, "Research Chemicals From Dow", listing more than 250 compounds that may be used in new product development work, is being offered by the Dow Chemical Co., Midland, Mich.

The catalog presents a wide variety of materials currently available in limited quantities from Dow and includes 120 more than were listed last year.

•

New Clark Fork Truck

A pneumatic tired fork-lift truck of 5000 lbs. capacity, designed for outdoor use over rough terrain, has been added to the "Clark-lift" line of fork trucks produced by the Industrial Truck Division of Clark Equipment Co., Battle Creek, Mich.

Named the CY-50, the unit features a two speed, power shift transmission with a manually controlled "creeper" gear, a turning radius of 88½ inches, power steering, and a swing-out hood for complete accessibility to the engine.

•

Dorr-Oliver Catalog

Dorr-Oliver, Inc., Stamford, Conn., is offering five new two-color equipment bulletins bound in a single catalog entitled, "Dorr-Oliver Pumps for Hot or Cold Corrosive and Slurry Service."

The catalog describes the complete D-O pump line for chemical process and allied industries. Included are line and wash drawings, photographs, specification and performance data, and parts lists.

•

Spraying Systems Strainer

The Spraying Systems Co., Bellwood, Ill., has introduced the 8060 Suction Strainer for use on spray rigs. This large capacity strainer is said to provide a 75 per cent greater open screen area than previous models.

It is designed for spray rig applications where a large volume of liquid per minute is to be sprayed. Complete information on the strainer is available from the company at 3230 Randolph St., Bellwood.

THE MAN WITH THE ★ MULTIWALL PLAN

UNION
PACKAGING SPECIALIST
GENE CARTLEDGE

helps Multiwall user reduce bag costs $4.05 per M

In Multiwall packaging, paradoxically, it's sometimes necessary to add in order to reduce. Take the case of one leading company whose bag designs recently were analyzed by Union Packaging Specialist Gene Cartledge.

The firm uses Sewn Open Mouth Multiwalls in part of its operation. Cartledge recommended adding Union's special SEW STRONG construction (reinforcing strips at top and bottom of bag). The stronger closure enabled the basis weight of each bag to be reduced by 10#. The new sewing method led to a reduction in bag length, an improved bag design—and $4.05 per M savings! Another recommendation: convert all the firm's present Sewn Valve Multiwalls to Sewn Open Mouth types. This complete changeover will further streamline bagging and, based on the company's annual requirements, result in thousands of dollars in additional savings.

Union Multiwall Recommendations are based on this 5-Star Packaging Efficiency Plan

- DESIGN
- EQUIPMENT
- CONSTRUCTION
- SPECIFICATION CONTROL
- PLANT SURVEY

Every day, Union's 5-Star Packaging Efficiency Plan is helping packers like yourself get more for their Multiwall investment. Yet it costs nothing to put it into action. Write today for complete details.

Better Multiwall performance through better planning

union camp

UNION'S PACKAGE ENGINEERING DEPARTMENT will study your Multiwall bagging methods and equipment and make appropriate recommendations, regardless of the brand of Multiwalls you are now using.

UNION MULTIWALL BAGS
UNION BAG - CAMP PAPER CORPORATION
233 BROADWAY, NEW YORK 7, N. Y.

MISSISSIPPI MEETING

(*From Page* 78)

Corviss, chief pilot, Mississippi Valley Aircraft Service, Clarksdale, gave an inspiring message to the association on "The Pilot's Responsibility and Obligation to his Employer." Proper care of the aircraft, loyalty, laziness, the pilot's moral obligation, and employer relations were points most adequately covered in the talks.

Attending the Conference and addressing the group were: C. A. "Bud" Moore, director, Mississippi Aeronautics Commission; Frank Wignall, safety officer, Federal Aviation Administration, whose headquarters is in Jackson; Dr. Marvin Merkel, U. S. D. A. entomologist, Stoneville, Mississippi; Bob Monroe, assistant executive director, National Aviation Trades Association, Washington, D. C.; and Richard Griffith, technical sales representative, Hercules Powder Company, who served on the welcoming committee with Mr. Emery.★★

TEXAS APPLICATORS

(*From Page* 77)

impossible to get into the field with ground equipment, Mr. Smith concluded, airplane dusters can play an important role in disease control.

More than 360 people registered for the conference which was sponsored by the Texas A&M College System, the Texas Aeronautics Commission, and the Texas Aerial Applicators Assn. Ten booths were set up outside the conference room for chemical and equipment dealers. Among the exhibitors were the Spraying Systems Co., Waco, Tex. and the Chipman Chemical Co., Bound Brook, N. J.

Airplanes exhibited to the conferees at the Easterwood Airport in College Station included the Grumman Ag-Cat, The CallAir, The Fletcher (a new Zealand airplane equipped with a Swathmaster sprayer), The Champion, the Snow S-2, and a Whitney-Simpson high lift wing Stearman.★★

PRESCRIPTION CONTROL

(*From Page* 61)

about 15 persons, not counting extra help employed to operate the spray rigs during the season."

Mr Greene spends a great deal of time in the field, leading panel discussions, giving talks, and teaching. He drives an average of 65,000 miles a year and makes frequent air trips to such points as Portland and San Francisco.

Studies being carried on in Tulelake at this time have to do with brush spraying. Mr. Greene reports that they have developed methods for applying herbicide pellets to roadsides by helicopter. The industry is still in its infancy, he believes. Eventually, he predicts, we will even treat potato pieces so they will be immune from bacteria. He credits his company's success to first hand experience with every chemical they use.★★

TWO LOUISIANA CORPORATIONS, the Louisiana Limestone Distributors, Alexandria, and the Pelican State Lime Corp., Morgan City, have been granted charters of incorporation to deal in limestone and fertilizer.

EFFECT OF UREA

(*From Page 50*)

bilities of combinations of urea and ammonium nitrate or ammonium chloride limit the amount of urea which can be used.

Limits which have been found to be satisfactory, in that there is sufficient urea to alter the crystal structure of ammonium chloride and still not be soggy, are 20 to 50 pounds of urea per ton of end product made with ammonium nitrate solutions. Limits of 30 to 45 pounds have been found to be even better. Fertilizers containing soluble salts such as ammonium nitrate and/or urea should best be dried below 2% moisture.

To obtain the desired amount of 30 to 45 pounds of urea per ton of end product the quantity of urea in an ammonium nitrate solution is adjusted to the amount of solution to be used. This amount of nitrogen solution is determined by the amount of nitrogen to be obtained from solution and the nitrogen content of the solution. When not over 300 pounds of solution is being used, a 15% urea content is acceptable. Where 700-750 pounds of solution are used, the urea content of ammonium nitrate solutions is limited to a maximum of 6%.

Effect of Addition of Ammonium Nitrate to Urea Ammonia Solutions

Three reasons why the addition of ammonium nitrate to urea ammonia solutions has not developed are: (1) The addition of small amounts of ammonium nitrate to urea ammonia solutions has relatively small effect on the solubility of the combined salt. (2) Urea is less soluble than ammonium nitrate in water or in ammonia-water solutions. Urea solutions, therefore, contain more water which may cause over agglomeration and increase the drying operation. (3) There is less need for altering the crystal shape of ammonium chloride when relatively small amounts of ammonium nitrate are added.

Selecting A Solution

It is usually economically desirable to obtain the highest amount of nitrogen possible from solutions. With high nitrogen grades large amount of nitrogen solutions may be used. The high fixed-to-free ratio of nitrogen in fertilizer solutions for high nitrogen mixed fertilizers is desirable in order to curtail the amount of acid needed to neutralize excess free ammonia. There would be one ideal solution, therefore, for each grade of fertilizer made under each set of conditions. It is usually desirable, however, to compromise on one or two solutions which best fit the range of manufacturing conditions within a given plant and a given area. A low fixed-to-free ratio solution along with a high fixed-to-free nitrogen ratio solution gives good versatility of plant operating conditions with lowest raw materials costs.★★

WILLIAM H. JACKSON has been elected to the board of directors of the Spencer Chemical Co., Kansas City, Mo. He had previously served for years as a Spencer director and recently resigned a position on President Eisenhower's executive staff.

HELICOPTER SPRAYING

(*From Page* 64)

ments were included and a randomized block design was used. Plots were about ten acres for each treatment and results were obtained from random samples of 25 full grown plants from one acre within each plot. Spray applications for the tests were made from October 3, 1956 to August 7, 1957, on 14-day cycles during the rainy season and on 21-day cycles after May. The plots were marked by tall bamboo poles and each plot required five 40-foot wide swaths. Materials applied were: Zineb at one-half per gallon of water or 20, 40, or 60 per cent oil; copper oxychloride at one pound per gallon of water or varying amounts of oil; and 100 per cent oil with no fungicide.

The differences between the treated areas and unsprayed check plots were significant, but differences among the various spray treatments were not significant except that there was a pronounced tendency towards improved control of Sigatoka with both fungicides as the oil content of the emulsion was increased. The application of 100 per cent oil gave excellent control, with little variation throughout the season. The precision of the helicopter application was well demonstrated in the sharp definition between treated plots and adjacent unsprayed checks.

During the same period, commercial spraying was conducted on several farms on which a total of 1,000 acres were treated 14 to 17 times. Copper oxychloride and a 60 per cent oil emulsion were used to obtain a highly successful control of the disease.

Following the results of these test programs, a number of banana exporting companies contracted for helicopters to serve their growers in 1958. From nearly 1,500 acres sprayed in 1957 by air, the figure rose to nearly 70,000 acres being sprayed in 1958, in Ecuador alone. From one helicopter on contract in 1957, nearly 30 were used in 1958. Small heliport loading sites are set up on most banana plantations in Ecuador. Oil is stored in advance and pilots can move from job to job rapidly. Under Ecuador conditions, one helicopter can spray from 8,000 to 9,000 acres per month.

Oil, alone, is being used because it gives the best control with the least cost of all materials tested. The precise action of the oil on the disease still is unknown, but it apparently protects the youngest susceptible leaves against infection and inhibits further development of infection already established in older leaves. In addition it inhibits the development of the conidia,

or asexual spores, of the fungus. There is evidence, however, that the oil does not kill or inhibit the fungus pathogen on the leaf surface. Bordeaux mixture, by contrast, does kill the fungus spores when they land on the sprayed leaf surface but is unable to stop leaf spot development once infection has occurred and entered into the leaf.

Palm trees projecting 100 feet above the tops of the banana plants, which average 30 feet in height, present a hazard to aerial applicators as do clumps of bamboo interspersed throughout plantations and the 150-foot high jungle trees bordering them. Only helicopters seem able to travel at 40 miles per hour within five feet of the banana plant tops while maintaining reasonably straight courses at 50 foot intervals.

A solution to the problem of financing helicopter spraying was found when the Standard Fruit Company, a U. S. concern, and the Exportadora de Frutas Ecuadorianas, a German company, contracted for helicopters to spray the plantations from which they purchased fruit, assuming one-half of the cost of the operation themselves and deducting the remainder from payments paid by them to the grower. The exporters also assumed responsibility for overseeing the spraying operations and furnished their own technicians. This caused a substantial portion of the more productive banana plantations in Ecuador to be under disease control during the first year of commercial spraying operations.

Investigations now are being carried on to determine the optimum balance of oil (or oil emulsion) and fungicide for sprays and to obtain a more accurate control of the spectrum of droplet size. Airplanes are being used in some areas of Ecuador as well as knapsack mist blowers and helicopters to get good, economic, control of the disease with current oil sprays, but accurate control of droplet size offers the possibility of reduction in the gallonage applied per acre together with more dependable control and reduced danger of phytotoxicity and fruit blemish. Steady advances in equipment design and fungicide formulation are to be expected from the governmental agencies and manufacturers working on the problem.★★

ENDOTHAL

(*From Page* 39)

there is evidence indicating that this compound tends to follow the movement of water through soils.

Adoption of chemical weed control in sugar beets has been slow due to the fact that weeds were usually satisfactorily eliminated by the hand thinning operations even at costs as high as $10 per acre. However, with the development of mechanical thinning machinery, coupled with the use of monogerm seed, it has become necessary to supplement weed control with a chemical herbicide in

order to reduce or eliminate hand labor. Endothal weed killer is well adapted for use in this weed control program because of its broad spectrum of weed control of both broad leaved and grass weeds with no phytotoxic effects on beets in pre-emergent applications. Some of the weeds controlled in this crop are cheat grass, wild oats, red root or pigweed, Kochia, Setaria, burr clover, Texas blueweed (henbit), volunteer barley, wild buckwheat, barnyard grass, green foxtail, crabgrass, bullgrass, annual blue grass, ragweed, purslane, smartweed, carrot weed, and shepherd's purse.

In general, application of four to six pounds of technical (two to three gallons of endothal weed killer) per acre on a broadcast basis (all the surface covered) have been found to be most satisfactory for use on beets under a wide variety of conditions in both sprinkler-irrigated and high rainfall areas. Results of a typical application are shown in Figure 3. Band treatments on a six inch wide area over the row reduce the amount of chemicals required to one-fourth or more depending on row width. Band treatments applied on the above basis can be made at a cost of $2 to $5 per acre for the chemical, using the liquid endothal weed killer formulation.

A granular formulation containing 5% endothal has given successful control, as indicated in Table VII in data obtained by Dr. Russell Nash[8] at the North Platte Experiment Station in Nebraska. However, complete evaluation of this dry material is still in progress at the time of this report. Efforts are being made to develop better machinery for more uniform application of this type of formulation.

The endothal weed killer formulation is now registered with the USDA for use on sugar beets, red beets, and spinach for weed control in premergent applications only at planting time.

Considerable experimental work is in progress on the best methods of soil incorporation under different irrigation practices with both liquid and granular forms.★★

About the Author

Dr. Harold J. Miller is head of Agricultural Chemicals Section, technical development department, Pennsalt of Washington Division. Before joining Pennsalt, he was plant pathologist with the Pennsylvania Agricultural Experiment Station.

References

1. Linden P. J., Proc. Northeast. Weed Control Conf., p. 7 (1951
2. Laumeister, L. T., Private Communication (1956)
3. Noll, C. J., Weeding of Beets with Chemical Herbicides, Proc. Northeast. Weed Control Conf., p. 108-9 (1959)
4. Danielson, L. L., Chemical Control in Over-wintered Spinach, The Vegetable Growers News (Virginia), 10(6), 1-2 (1955)
5. Nelson, Russell, Private Communication (1956)
6. Alley, Harold, Mimeographed Report (1956)
7. Bischoff, R. K., Private Communication (1959
8. Nash, Russell, Effect of Several Pre-Emergent Treatments on Stands of Sugar Beets and Weeds, North Central Weeds Control Conf., Research Report, p. 112 (1957)

BAY-SOL® NITROGEN SOLUTIONS

ANHYDROUS AMMONIA

AMMO-NITE® AMMONIUM NITRATE FERTILIZER — 33.5% NITROGEN

More in service, more in quality!

Technical service field representatives, to aid you with any problem, are as near as your telephone.

Modern, easily accessible manufacturing plant and continuing research.

Conveniently located service offices.

Manufactured by

Escambia Chemical Corporation
Pensacola, Florida

Distributed Exclusively by

Ashcraft-Wilkinson Company
Atlanta, Georgia

BRANCH OFFICES: Norfolk, Va., Charleston, S. C., Tampa, Fla., Jackson, Miss., Montgomery, Ala., Columbus, Ohio, Des Moines, Iowa.

NEW!

A BAUGHMAN EXCLUSIVE!

Lube-Impregnated Chain Drive on the K-5 Lime and Fertilizer Spreader

Advantages of New Lubrication Feature:

- ***Positively Insures Greater Corrosion Resistance***
- ***Virtually Eliminates Chain "Freezing"***

Baughman K-5 Spreader Body Also Features:

- Tough 40,000 lb. test malleable block chain (total strength) . . . strongest ever used for spreader body discharge.
- Belt Conveyor Discharge (if preferred).
- Choice of four drives.
- Reinforced top edge, extended side jacks and internal bracing for full body support . . **STRONGEST SPREADER BODY EVER BUILT!**

Better Service Through Better Engineering.
Service and Parts from 200 Service Branches.

WRITE TODAY for illustrated Bulletin A-424

BAUGHMAN

BAUGHMAN MANUFACTURING CO.

233 SHIPMAN ROAD • JERSEYVILLE, ILL.

PHILIP D. KENT has been named district manager for the Chicago territory of the Multiwall Division of the Hudson Pulp & Paper Corp.

GRANULAR PESTICIDES

(*From Page 32*)

carrier in the dry form, followed by blending for a few minutes. Then the pesticide can be sprayed safely into the deactivated carrier. Alternately, these deactivators may be added to the granules as aqueous solutions—urea as a 50% solution and HMT as a 40% solution. The dry addition of the powdered deactivators does not appreciably increase the fines in the finished pesticide, because the powder clings to the surface of the granules. With the addition of the aqueous solutions, contact between deactivator and sorptive carrier is more intimate, but there is a danger of decreasing the soptive capacity because of increased free moisture content.

In the case of Deactivator H with heptachlor, the deactivator can conveniently be added to the technical heptachlor in a mixing vessel before impregnation.

Special Considerations

UNDER certain conditions, some formulations tend to produce a somewhat wet or oily finished material. Even though not visibly wet, such products are quite prone to cake or set up after packaging. In formulations exhibiting this tendency, an aging or curing period is sometimes allowed before packaging. The finished product is simply stored in piles or in open drums and excess solvent is lost by volatility. The time period also allows better distribution of the pesticide and solvent, and their penetration from the surface to the interior of the granule. A good volume of air flowing across the granules during some stage of processing subsequent to impregnation would also remove some excess solvent. Such an air stream should be exhausted to the outside atmosphere with precaution against fire.

Good insurance against caking is to follow correct formulating procedures, and to use a satisfactory type of carrier, freshly prepared and without excess free moisture.

Conditioning of highly concentrated formulations such as 20 and 25% granular hepatchlor is highly beneficial, and eliminates the need for an aging period. After impregnation has been completed, a finely milled conditioning agent, such as a diatomaceous earth, can be added to the extent of 3 to 5% of the completed batch and blending continued for a few minutes. The finely divided diatomaceous earth coats the surfaces of the granules, and inhibits their tendency to stick together. The per cent of free dust in the product is not increased significantly because the diatomaceous earth powder adheres quite firmly to the granules.

There is some evidence that in certain special cases, a mixture of two different granular carriers may give a better product than either one alone. It is believed the dissimilar surface forces asserting themselves in the system influence the nature of crystal growth of the pesticide. The change in crystal growth pattern may result in less tendency to cake.

Conclusion

MANY field uses of granular pesticides are well established and the production of high quality materials to meet the present requirements of these control programs is readily accomplished by standard methods. Floridin-attapulgite carriers combine the versatility and high sorptive capacity which are required in many of these formulations. New and expanded applications of granular pesticides continue to be developed. The search for further improvements in products and new techniques for their manufacture continues for the purpose of bringing safer, more effective weapons into man's continuing battle against destructive agricultural pests.★★

ALBERT F. ROTHWELL has been elected secretary and treasurer of the National Potash Co., New York.

FUNGICIDES

(*From Page 42*)

portant, the answers will also vary, because what is the most suitable fungicide in one place and under one set of conditions is not necessarily the most appropriate in another.

This kind of information the dealer can most logically obtain from his county agent. If the county agent does not have a ready answer, he may be able to provide one from the store of state and federal literature which he has at his disposal. Or he may put the dealer in contact with the plant pathologists at the state experiment station who directly or by means of the various appropriate bulletins and circulars on disease control can give the most up-to-date information on the use of fungicides for that part of the country. Experienced and successful growers may also supply excellent and timely information.

Future Trends

THE search for new and better fungicides continues and new ones (i.e. mostly new formulations rather than new active ingredients) obtain a foothold every year. The discovery and introduction into the trade of basically new fungicides is not as rapid as it is for insecticides and herbicides. One explanation is that the fungus is also a plant and it is difficult to find a chemical that will kill the fungus but at the same time not injure the green plant. In several areas there is special activity. One is in soil fungicides, where advances and new materials can be expected. Another is in the control of powdery mildews and rust diseases. There is no practical chemical control for such very important diseases as stem rust of wheat. The goal here is a so-called systemic fungicide that could be applied to the plant or soil and on being taken up would impart an immunity in the plant to the disease in question. Systemic fungicides could also be used effectively against the various wilt diseases including those of trees. A few experimental compounds have given interesting results; the answer may be found in as yet undiscovered antibiotics, or synthetic organic compound.

Progressive dealers, especially interested in new developments, may keep abreast by reading current articles in publications such as *Agricultural Chemicals* and the farm magazines. Also every year the fungicide specialists in The American Phytopathological Society, get together a report of tests conducted all over the United States and Canada on the newer fungicides. 3.

[3]Results of tests from 1953 to 1956 appeared in *Agricultural Chemicals*. The current report, "Results of 1957 Fungicide Tests," may be obtained for $1.00 from Dr. A. B. Groves, Department of Plant Pathology, Virginia Agricultural Experiment Station, Rural Route 3, Winchester, Virginia.

Thus as a dealer keeps up to date and provides both accurate information and suitable fungicide materials, so will his own business prosper.★★

FERTILIZER CAKING

(*From Page 37*)

The superphosphate analyzed:

	Ordinary	*Triple*
P_2O_5 total	21.6	47.5
P_2O_5 citrate soluble	20.4	45.9
P_2O_5 water "	18.8	38.9
Free acid, as P_2O_5	3.2	0.56
Free water	7.2	3.0
SO_3	31.9	2.2
CaO	29.2	21.3

Based on the above analysis we have, for the ordinary superphosphate:

$CaSO_4$ as CaO 22.34%

Citrate insoluble P_2O_5 $(Ca_3(PO_4)_2)$ as CaO 1.42%

remaining $(29.2 - (22.34 + 1.42))$ 5.44% of CaO available to react with 12.8% of $(NH_4)_2SO_4$. The CaO from the citrate-soluble $CaHPO_4$ becomes available for the

$(NH_4)_2SO_4$ because of the excess of free acid present.

For the triple superphosphate we have similarly:

$CaSO_4$ as CaO	1.54%
Citrate insoluble P_2O_5 ($Ca_3(PO_4)_2$) as CaO	1.90%
Citrate soluble P_2O_5 minus water soluble ($CaHPO_4$ as CaO	5.53%

remaining $(21.3 - (1.54 + 1.90 + 5.53))$ 12.33% of CaO available to react with 29.1% of $(NH_4)_2SO_4$. In this case, in contrast to the previous one, the CaO from the $CaHPO_4$ has to be considered as unavailable to react with $(NH_4)_2SO_4$, because there is practically no free acid present, and $CaHPO_4.2H_2O$ is less water soluble than $CaSO_4$.

What would be the physico-chemical interpretation of the linear proportionality shown in first section of curves of the Figures 6 and 7? Microscopical examination showed that the "amorphous" superphosphate particles are "covered" by needles which link together these particles. To explain the linear proportionality we must assume that the needles grow only on their extremities, fed by material from the particles, with lateral growth being negligible. This lengthwise growth would be proportional to the amount of ammonium sulfate added, and in consequence the volume increase is also a linear function. W. A. Mitchell (7) verified the growth of ammonium chloride in a granular fertilizer to be only lengthwise. (in our experiment however ammonium chloride was not present).

Recommendations To Reduce Caking

TO minimize bag caking of pile-cured mixed fertilizers including ammonium sulfate and superphosphate in their formula, we recommend:

1st:—Water spraying during the mixing process. Large scale work has shown that the addition of about 2% water promotes a more rapid and complete reaction in the pile. There is some evidence that this practice reduces the needed curing time to about 15 to 20 days. The spraying is done in the mixer by means of spray nozzles. The physical characteristics of the sprayed and cured fertilizers are similar to formulations without this addition.

2nd:—Addition of about 2% rock phosphate to all grades compounded only with superphosphate, ammonium sulphate and potash. Laboratory tests (not described in this paper) have shown that fertilizers prepared with superphosphate containing an excess of free acid over the insoluble P_2O_5 present are muddy, even after curing, and are subject to pronounced caking not accompanied by chemical reactions. This kind of "caking" can be repeated several times with similar intensity by regrinding the caked material.

3rd:—Employ fresh super as long as its physical properties permit its handling, for compounding mixtures with ammonium sulfate. In the mixture, the superphosphate cures more rapidly and completely than when isolated.

Literature Cited:

(1) Adams, J. R., and Ross, W. H., *Ind. Eng. Chem.*, 33, 121-7. (1941).
(2) Association of Official Agricultural Chemists, Washington, D. C., Official Methods of Analysis. (1955).
(3) Crowther, E. M., Fertilizer Soc. Engl. Proc., No 5, 3-10. (1949).
(4) Hardesty, J. O., Vee, J. V., and Love, K. S., *Ind. Eng. Chem.*, 37, 567-73. (1945).
(5) Hardesty, J. O., *Agr. Chemicals*, 10, No 8, 50-1, 91, 93, 95, 97. (1955).
(6) Hill, W. L., and Beeson, K. C., J. Asoc. Offic. Agr. Chemists, 19, No 2, 328-38. (1936).
(7) Mitchell, W. A., *J. Sci. Food Agr.*, 5, 455-6. (1954).
(8) Rader, L. F., *Am. Fertilizer*, 108, No 12, 7-9, 26, 28, 30. (1948).
(9) Sauchelli, V., "Manual on Fertilizer Manufacture", 2nd ed., Baltimore, Md., Davison Chemical Company, 1954.
(10) Turbett, F. L., and MacArthur, J. G., *J. Agr. Food Chem.*, 2, 506-13. (1954).
(11) Whynes, A. L., and Dee, T. P., *J. Sci. Food Agr.*, 8, 577-91. (1957).

Acknowledgment

The authors wish to acknowledge the helpful suggestions received from John H. Hardesty, USDA, Bellsville, Md.

LOUISIANA MEETING

(*From Page 67*))

ing and that they must change with the times and look for new opportunities. During the past ten years, he said, the number of farms in Louisiana decreased from 124,181 to 101,650. Land used for harvested crops decreased from 3,149,000 to 2,500,000 acres. Cotton acreage decreased from 1,000,000 to 390,000 while pasture land increased during the same time from 4,700,000 acres to 6,000,000 acres. Dr. Burns predicted that other opportunities might be found in forest land since there are 16,000,000 acres of forests in Louisiana and there has been an average of 23,294 acres planted in trees each year for the past 30 years. He indicated that pecan orchards may eventually be treated from the air and that an increased acreage of treated sugar cane can be expected.

W. A. Rose of Lake Charles, La., and A. B. Leonard of Jennings, La., were elected to serve as president and secretary respectively for 1959. The group will meet again next year on Jan. 21 and 22.★★

FERTILIZER VIEWS

(*From Page 83*)

it is necessary to have a system that quickly and justly differentiates between honest and somewhat dishonest or sloppy practice. But at the same time, they like to know how advisable it is to try to get such a degree of homogeneity—which while it may ease the sampling chore, may also impose a cost burden on the farmer out of proportion to its value. This, of course, is another way of saying that the tolerances established for the determination of each plant nutrient in the analysis of a fertilizer should be imposed with careful consideration of the intended use of the product and the cost factor.

Someone has truly said, "Quality must be built into a

product, it cannot be inspected into it." Building quality into the fertilizer mixed goods which meet the specifications set forth by the agronomists and horticulturists has been and generally is the aim and avowed purpose of all reputable fertilizer manufacturers. Recent developments in marketing bulk fertilizer in certain areas, and which are apparently encouraged by local official agencies seem to ignore all previous agronnmic teachings about the necessity for homogeneity in the mixture and the close limits or tolerances in the guaranteed analysis. These developments are causing serious concern to manufacturers and control officials. We do not presume to know the answer. Enforcement of the chemical statutes or a re-appraisal of agronomic teachings in the light of new evidence that should be produced by scientifically organized field tests seem to be needed. In this connection—that is, field tests – it is suggested that here, also, the tests should be designed by statisticians skilled in modern techniques in order to assure dependable results.★★

BIOLOGICAL CONTROL

(*From Page* 34)

to ascertain the usefulness of the sterile-male technique against destructive pests other than the screw-worm for it may prove effective, reasonable in cost, avoids residues and other problems that follow the use of more insecticides.

The Entomology Research Division is cognizant of the advantages and limitations of many control methods and is striving to meet the most urgent problems within available resources. Efforts are being concentrated on new approaches to insect control, to safer chemicals, and to ways of employing chemicals with a maximum margin of safety.

Summary.—Natural biological-control agents are important in checking noxious insects and weeds, but their acceptance by growers in lieu of chemicals or other methods depends upon their furnishing economic control. They can be used to supplement insecticide or other methods when they cannot accomplish this purpose alone. The effectiveness of parasites and predators is illustrated by examples of their role against the oriental fruit moth, Comstock mealybug, Japanese beetle, cottony-cushion scale, European corn borer, and tobacco hornworm; of bacteria for control of the Japanese beetle, tobacco hornworm, and European corn borer, and virus diseases of the alfalfa caterpillar and the Great Basin tent caterpillar; of birds and mammals against the spruce budworm; by beetles to control Klamath weed; by rsistant varieties of plants against the European corn borer and spotted alfalfa aphid, and by irridation against the screw-worm.

The importance of biological control warrants a heavy investment in future research to evaluate the effectiveness of outstanding parasites, predators, and diseases against many destructive insects. The development of crop varieties resistant to insect attack provides an efficient and long-time control of insects, but research work on many insects and crops is lacking. The use of the sterilized-male technique in insect control for pests other than the screw-worm is practically untouched.★★

References Cited

Clausen, C. P. 1956. Biological control of insect pests in the continental United States. U. S. Dept. Agri. Tech. Bul. 1139, 151 pp.

Holloway, J. K., and C. B. Huffaker. 1952. Insects to control a weed. U. S. Dept. Agr. (Insects), Yearbook, pp. 135-140.

Knipling, E. F. 1957. Control of screw-worm fly by atomic radiation. Sci. Month. 85(4):195-202.

Morris, R. F., W. F. Cheshire, C. A. Miller, and D. G. Mott. 1958. The numerical response of avian and mammalian predators during a gradation of the spruce budworm. Ecology 39 (3):487-494.

Painter, R. H. 1958. Resistance of plants to insects. Ann. Rev. Entomol. 3:267-290.

CLASSIFIED ADVERTISING

Rates for classified advertisement are ten cents per word, $2.00 minimum, except those of individuals seeking employment, where the rate is five cents per word, $1.00 minimum. *Check must accompany all classified advertisements.* Address all replies to Classified Advertisements with Box Number care of AGRICULTURAL CHEMICALS, P. O. Box 31, Caldwell, N. J. Closing date: 10th of preceding month.

Situations Wanted:

AGRONOMIST, M.S. Age 35, single, extensive experience in domestic, foreign and tropical agricultural field. Desires responsible position with progressive concern. International, technical liaison, sales position preferred. Address Box 221, c/o Agricultural Chemicals.

AGRONOMIST (Ph.D. Soil Fertility) Broad background in research, extension and teaching. Available for summer employment. Will travel. Address Box 222, c/o Agricultural Chemicals.

Have you a service to sell?
Are you a consultant . . .
a representative?
a salesman?

Offer your talents, your services, your facilities in the agricultural chemical industry's only professional directory.

Advertising rates on request.
N. Y. Phone: BArclay 7-7121
Caldwell, N. J.: CApital 6-5520

AGRICULTURAL CHEMICALS
P. O. Box 31 Caldwell, N. J.

AC ON MICROFILM

All issues of AGRICULTURAL CHEMICALS are available on Microfilm.

Librarians and other interested subscribers can contact University Microfilms, 13 North First Street, Ann Arbor, Mich., for price information and copies.

For Sale:

SALE: Horizontal Aluminum Tank 4,000 gallons. Steam Tube Dryers (Tubes Removable) 6' x 50', 6' x 25', 4' x 30'. Also Mixers, Bucket Elevators, Screw Conveyor, Hammermills, Pulverizers, etc. Perry Equipment Corp., 1428 N. 6th St., Phila. 22, Pa.

Miscellaneous:

AGRICULTURAL LAND in prosperous Montana $25 per acre. Mineral rights often included. Excellent appreciation possibilities. G. A. Stevens, Box 861, Havre, Mont. Licensed-bonded broker.

ZONOLITE VERMICULITE —a free-flowing, highly absorptive, inorganic, lightweight carrier for any type chemical. Low density. Cuts carrier costs. Formulates without caking or balling up. Technical information and assistance to help you work out new formulae on confidential basis. Also working samples, prices. Dependable service and supply from over 40 ideally located Zonolite plants.
ZONOLITE COMPANY, Industrial Div.
Dept. AC, 135 S. LaSalle St., Chicago 3, Ill.

Now Available
1958 Proceedings
FERTILIZER INDUSTRY ROUND TABLE
PRICE $3.00
Proceedings of the 1958 Fertilizer Industry Round Table meeting are now available. Complete reports covering some 150 fertilizer production problems are included in the 116 page booklet.
Send check with order to:
H. L. MARSHALL
1604 Walterswood Road
Baltimore, Md.

PROFESSIONAL DIRECTORY

SOIL & PLANT TESTS
SOIL FERTILITY PROBLEMS
EVALUATION OF AGRICULTURAL CHEMICALS
Dr. Wolf's Agricultural Laboratories
2620 Taylor St. Hollywood, Fla.

ALVIN J. COX, Ph.D.
Chemical Engineer and Chemist
(Formerly Director of Science, Government of the Philippine Islands. Retired Chief, Bureau of Chemistry, State of California, Department of Agriculture.)
ADVISER ON AGRICULTURAL CHEMICAL PROBLEMS AND INVESTIGATIONS
Consultant in reference to spray injury and damage, claims, including imports of fruits and nuts, formulas, labeling, advertising and compliance with law.
1118 Emerson Street
Palo Alto, California

Chemical & Engineering Analyses, Research & Development
Agricultural Chemical Analyses.
Insecticides, Fungicides, Herbicides, Rodenticides, Fertilizers.
Toxicology. Market Research.
Product Development.
Ask for complete details: call — WAtkins 4-8800 or write to:
SNELL Foster D. Snell, Inc.
29 W. 15th STREET
New York 11, N. Y.

FLORIDA FIELD TRIALS
Evaluations
of
Agricultural Chemicals.
DR. G. R. TOWNSEND
Box 356
Belle Glade, Florida

Sperling Laboratories
Toxicology — Pharmacology
Physiology
Soil Analysis
Frederick Sperling, Ph.D
Formerly Pharmacologist-in-Charge
Pharmacological and Rodenticide Laboratory
U. S. Department of Agriculture
6815 N. 24th St. Arlington 13, Va.

Theodore Riedeburg Associates
Sales Consultants
and
Manufacturers' Representatives
on
Agricultural Chemicals
415 Lexington Ave.
New York 17, New York
MUrray Hill 7-1488

INDEX to ADVERTISERS

TALE ENDS

THE importance of insect detection, as a prerequisite to efficient insect control, has recently been further emphasized by the request of several plant pest regulatory and other agricultural agencies for increased emphasis on this phase of the USDA's pest control Division of ARS, USDA, has responded by initiating a new nationwide program designed to detect any newly introduced insect pest not now occurring in the U. S., or the spread of any existing pest into areas into which it has not previously occurred.

E. D. Burgess, director of the plant Pest Control Division urges all economic entomologists and cooperators in the Division's detection program to participate in the new undertaking. He emphasizes that if pests such as the European corn borer (which cost growers an estimated $158,000,000 in 1957) the pink bollworm, gypsy moth, etc., had been detected when first introduced, and while infestations were still local, costs of eradication would have been relatively minor.

AC

Soil conservation will be publicized with a special U.S. postage stamp to be issued August 26, 1959, at the annual meeting of the Soil Conservation Society of America, to be held at Rapid City, S. D. This stamp, says Postmaster General Arthur E. Summerfield, "should help focus public interest on the extensive soil conservation efforts being made by Federal and State governments, local soil conservation districts, watershed associations and other private and public groups." Details of design and color will be announced later; 120 million of the new 4¢ stamps will be issued.

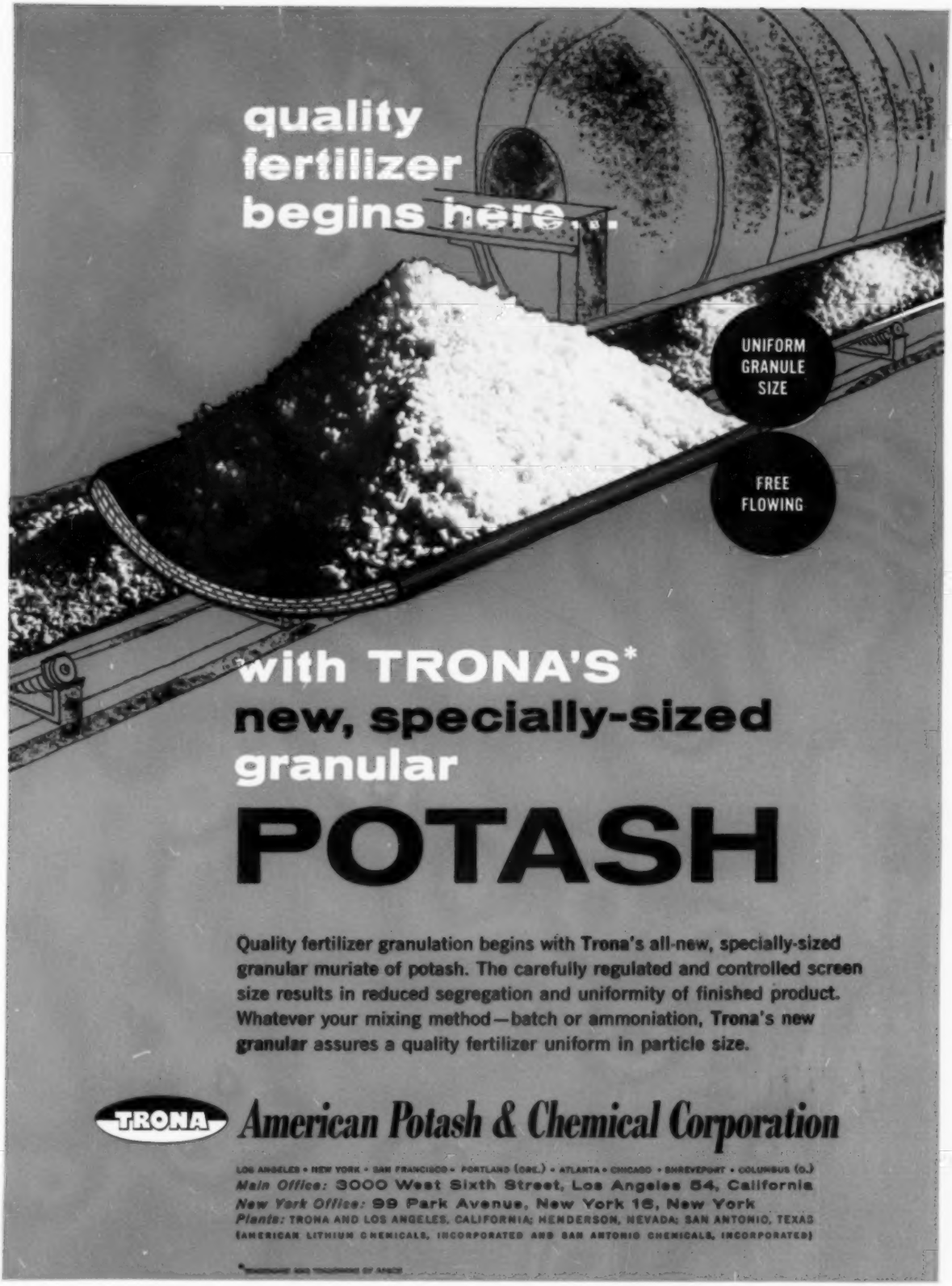
AC

New use for fertilizer—A ski resort operator, Louis Cochand of Ste. Marguerite, Quebec, Canada, is using ammonium nitrate on his ski slopes to harden the sun-softened snow and prolong the skiing season. G. R. Snyder, technical service manager of the agricultural chemicals division of Canadian Industries, Ltd., who supplied the product, points out that the snow-hardening effect results from the fact that ammonium nitrate is deliquescent. "When spread on soft snow it draws the moisture from it and in about 15 minutes forms a hard granular surface. . . When the snow is gone, the fertilizer remains to strengthen grass growth and provide a better surface to hold next year's snow.

AC

An assembly line is shown at Purdue University putting together manuals for the annual Pest Control Operators Conference. The mammoth job of assemblying 500 manuals is completed in short order through the combined assistance of the staff and students. Some of those pictured are: front row, left to right, G. E. Gould, B. E. Montgomery, and J. J. Davis. The three staff members just behind Dr. Gould are, left to right, M. Curtis Wilson, R. T. Everly, and H. O. Deay.

The manuals are prepared each year, and total some 150 pages.


quality
fertilizer
begins here...
UNIFORM
GRANULE
SIZE
FREE
FLOWING
with TRONA'S*
new, specially-sized
granular
POTASH
Quality fertilizer granulation begins with Trona's all-new, specially-sized granular muriate of potash. The carefully regulated and controlled screen size results in reduced segregation and uniformity of finished product. Whatever your mixing method—batch or ammoniation, Trona's new granular assures a quality fertilizer uniform in particle size.
TRONA
American Potash & Chemical Corporation
LOS ANGELES • NEW YORK • SAN FRANCISCO • PORTLAND (ORE.) • ATLANTA • CHICAGO • SHREVEPORT • COLUMBUS (O.)
Main Office: 3000 West Sixth Street, Los Angeles 54, California
New York Office: 99 Park Avenue, New York 16, New York
Plants: TRONA AND LOS ANGELES, CALIFORNIA; HENDERSON, NEVADA; SAN ANTONIO, TEXAS
(AMERICAN LITHIUM CHEMICALS, INCORPORATED AND SAN ANTONIO CHEMICALS, INCORPORATED)
*REGISTERED AND TRADEMARK OF APCO
Producers of: BORAX • POTASH • SODA ASH • SALT CAKE • LITHIUM • BROMINE • CHLORATES
PERCHLORATES • MANGANESE DIOXIDE and other diversified chemicals for Industry and Agriculture

HERCULES RESEARCH–
First Step Toward Improved Pesticides

From the Hercules Research Center and Agricultural Chemicals Laboratories come an ever increasing number of products that contribute to more productive farming and increased comfort for leisure hours. Here are the established members of the Hercules family: *Toxaphene agricultural insecticide; Thanite® for oil base and aerosol insecticides; Delnav* phosphate pesticide; meta Delphene® insect repellent; Delrad® algicide.*

Today in the laboratories research continues on the products that will join them in the future. But before they become available you can be sure that thousands of compounds have been carefully screened and extensive tests conducted in the field because only the best is good enough to meet the standards of Hercules research. That's why you can look to Hercules for leadership in the development of insecticides, fungicides, and herbicides.

Agricultural Chemicals Division, Naval Stores Department

HERCULES POWDER COMPANY

INCORPORATED

900 Market Street, Wilmington 99, Delaware

**Trademark*